INSTRUCTIONAL STRATEGIES:
Multivariable Studies of Psychological Processes Related to Instruction

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Semi-Annual Report

January, 1971

Advanced Research Projects Agency

ARPA Order No. 1269

Monitored by

Office of Naval Research

Contract Number N00014-67-A-0385-0006

Department of Educational Psychology

The Pennsylvania State University

SEMI-ANNUAL REPORT

July 1, 1970 - December 31, 1970

ARPA Order Number:	1269
Program Code Number:	60949
Name of Contractor:	Pennsylvania State University
	University Park, Pennsylvania 16802
Effective Date of Contract:	1968 September 1
Contract Expiration Date:	1970 August 31
Contract Number:	N00014-67-A-0385-0006
Principal Investigator	Francis J. Di Vesta
and Phone Number:	865-6347
Title of Work:	Instructional Strategies

Sponsored by
Advanced Research Projects Agency

ARPA Order No. 1269

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Copies of this volume and of two preceding volumes,

Di Vesta, et al. Instructional Strategies: Multivariate Studies of Psychological Processes Related to Instruction. Semi-Annual Report, January, 1970.

Di Vesta, et al. Instructional Strategies: Multivariate Studies of Psychological Processes Related to Instruction. Annual Report, July, 1970.

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Foreword

Since our last report we have developed through discussion and research the "evolving theory of instruction" presented by Di Vesta (July, 1970). The six technical reports and nine progress reports included in this semi-annual report represent a part of this development. It is our intent to present in this forward some flavor of our discussions, in which we attempted to integrate the research in this and previous reports within the theoretical framework presented in our 1970 Annual Report.

Our theorizing about instruction has been characterized by a conception of the learner as an active analyzer and synthesizer. No matter what message is presented or what teaching method is used, instruction provides only potentially effective stimuli for the student. If the message is to become effective, the learner must be motivated to attend and he must have a cognitive structure requisite for appropriately analyzing the message. The features of the message that became salient for the learner are presumed to be functions of his past experience, aptitudes, and attitudes. We have completed a number of studies relating to the learner's involvement in analysis of the instructional message, the first of two broad stages in our theory. We shall review these, and then discuss those studies which are more related to the second broad stage of learner involvement, synthesis of the learning outcome.

Ingersoll (July, 1970) presented evidence that the learner's preference for visual or auditory modality determines which features of the instructional message actually are recorded in the learner's sensory register. The motivation to seek out particular parts of a message for further attention was studied by Schultz (July, 1970). Silvestro (July, 1970) demonstrated that the motivational effects of stimulus characteristics in the Schultz study would vary in a predictable manner contingent on the learner's immediately prior experiences.

If the learner is motivated and the instructional message registers, then particular instructional methods, such as providing adequate contextual cues within the message (Di Vesta & Ross, July, 1970), instructing the learner to look for particular parts of the total message (Gray & Di Vesta, January, 1971), and clustering common elements of the message together (Sanders, Di Vesta, and Gray, January, 1970; Schultz, January, 1971), seem to facilitate the learner's analysis activities. Schultz and Di Vesta (January, 1970) have also demonstrated that authoritative guidance has differential effects on analysis in problem-solving situations, contingent on the dogmatism of the learner.

However, the relationship between environmental and learner variables in the learner's analysis stage is only part of our conception of learning from instruction. The learner is also very much involved in doing something with the instructional messages he has received. This second step is the synthesis stage, in which the learner makes interpretations of what is to be learned. These interpretations lead him to perform some level of transformation of the message in order to attain the desired instructional outcome, and often will affect and be affected by instrumental activities, such as note-taking and overt verbalization.

One completed study (Weener, January, 1971) and two that are in progress (Weener; Sanders) are directly concerned with the effects of different testing procedures on the learner's interpretation of the desired instructional outcome. Sanders' (January, 1970) study is also an attempt to demonstrate how learners come to interpret the demands of given instructional tasks. Weener (January, 1970) reported on a study of differential effects of anxiety and task demands on the desired outcome of creative responses.

Several project studies have focused directly on the transformational processes posited by Di Vesta (July, 1970) in the "Evolving Theory of Instruction." Sanders and Tzeng (January, 1971) have provided some basis for the distinction between rote and conceptual transformations, by demonstrating differences in the learner's uses of the instructional messages as well as by providing some support for relevant learner differences. Also, the set of studies called "Project Ikon" (three by Di Vesta and one by Ross & Di Vesta) that are in progress promise to define another facet of transformational processes, as related to instruction, in terms of the learner's dependence on visual or verbal imagery.

Finally, the project has resulted in a relatively large number of studies in the domain of instrumental activities. The effects of taking notes has been studied as a function of (1) whether notes may be reviewed (Peters & Harris, July, 1970; Di Vesta & Gray, January, 1971), (2) rate of presentation of message (Peters, January, 1971), and (3) organization of the instructional message (Schultz, January, 1971; Gray & Di Vesta, in progress). Also, Weener (in progress) is investigating whether there are differences between the notes taken by students who expect an immediate recall test and those taken by students who expect a delayed test.

In addition to the instrumental activity of note-taking, we have reported several studies related to verbalization as an instrumental activity. Schultz (July, 1970, and in progress) has focused on the instructional strategy of having students perform recitation exercises and is studying the conditions under which recitation can be made effective for learners whose anxiety is debilitating. Weener (July, 1970) also studied the effects of anxiety resulting from students making their own oral presentations of the instructional message to others.

This brief review of project studies is only a rough overview of past and present work within the theoretical framework described by Di Vesta in the "Evolving Theory of Instruction." We intend to culminate the present project this summer by a much more detailed specification of our "theory", which will include an integration of research done by others with our own investigations.

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TECHNICAL REPORTS

Summary

The Relationship between Rote and Conceptual Learning

Nicholas M. Sanders and Ovid Tzeng

Technical Problem

Rote learning processes and concept learning processes were hypothesized to be separable and independent by virtue of their resulting in different learning outcomes and also being differentially related to learner characteristics. In particular, rote learning was postulated to require stimulus compounding, which would lead to accurate identification of stimuli after learning was completed, while concept learning was assumed to require stimulus component selection, which would lead to errors in stimulus identification caused by overgeneralizing the concepts learned. Individual differences in preference for and skill in rote and concept learning were predicted to relate differentially to performance in rote and concept tasks.

General Methodology

Subjects were individually administered three rote and concept learning individual difference measures, followed by a rote learning task, a concept learning task, or an unsystematic classification learning task. After criterion performance on the learning task, the subjects were given a test to determine whether the outcome of the learning task was accurate identification of materials involved in learning or generalization of these materials to other materials.

Technical Results

A one-way multivariate analysis of variance and multiple comparisons of learning task performance and the four measures derived from the learning outcomes test revealed that (1) the unsystematic classification task required more study time than the rote or the concept task, (2) the concept task resulted in greater generalization errors of what was learned to new materials, and (3) the unsystematic classification task resulted in learning outcomes more similar to those of subjects in the rote task than to those of subjects in the concept task. One of the three individual difference measures, preference for concept learning, was differentially related to performance in the three learning tasks as predicted in that it was negatively related to performance in the unsystematic classification task, positively related to performance in the concept task, and unrelated to performance in the rote task.

Educational Implications

Though the terms rote learning and conceptual learning are used by educators to apply to all types of educational settings (usually in an evaluative sense), the present investigation indicates several additional distinctions are important. First, there are some tasks where only rote learning is appropriate; conceptual learning may actually interfere. Also, if it is clear to the learner that conceptual learning is not appropriate, he (the college student, at least) can learn efficiently by rote processes. Finally, when a learner does learn by concepts, it must be recognized that he will have an inaccurate memory of the particular concept-irrelevant characteristics of the materials studied and may tend to over-generalize the concept. A more tentative additional

implication is that learners do seem to differ in preference for rote or concept learning, though it must be added that this preference seems to have an impact on learning only when the material may be learned in either way or when the appropriate process is unclear from the instructions.

The Relationship Between Rote and Conceptual Learning

Nicholas M. Sanders and Ovid Tzeng

In Di Vesta's (1970) theory of instruction the learner is depicted as an active organism, making interpretations of what is required in a given instructional setting and carrying out those processes, or transformations, that are consonant with his interpretation. Three basic types of transformational processes are postulated in the model: Type I - rote or associative learning in which the material is acquired more or less as presented, Type II - conceptual learning in which the learner utilizes abstract dimensions of the material presented, and Type III - inferential learning in which the aforementioned types are transferred to novel and appropriate implications, or organizations of the material presented. By definition, a Type III transformation is in an hierarchical relation to the first two types. However, the relationship between Type I and Type II transformations are not clearly specified by the model. The purpose of the present report is to describe more fully the nature and relation of these two transformation types.

The Type I-Type II distinction outlined above is similar to the distinction in experimental psychology between rote and concept learning tasks. In a rote learning task the learner is required to learn a different response for each stimulus presented. If the stimuli are similar to one another in certain characteristics (e.g., several are red or several are squares), the learner must use other characteristics of the stimuli

to distinguish one from the other. When the total set of stimuli in a rote task all have some characteristics in common, the learner must consider the particular combination of characteristics for each stimulus in order to avoid errors. This latter process will be referred to as stimulus compounding.

A concept learning task, on the other hand, requires that S learn a common response to more than one stimuli. Usually in the concept task the stimuli that are assigned as common response are similar in some characteristic(s) (e.g., all are red squares, even though they differ in size or number). Thus, the learner may come to ignore the characteristics of the stimuli that are not relevant to making the correct response in a concept task.

Metzger's (1958) work indicates there are process differences involved in learning in rote and concept tasks. He found that when the same stimuli were used in rote and concept tasks (1) learning was more rapid in the rote task than in a concept task in which stimuli were randomly assigned to response labels (an unsystematic concept task), but (2) learning in the rote task did not differ significantly from that in a concept task in which the concepts were defined by different values of the same stimulus dimensions (a systematic concept task). (Systematic concept tasks are most often used in research on the learning of multiple concepts; an example is the use of color and shape as relevant dimensions, with red square being one concept, blue square another, red circle a third, and blue circle a fourth.) Metzger suggested that his results could be explained by postulating that one factor, response interference, is always present when a response must be associated with two or more discriminably different stimuli, but that response interference is somewhat offset by

a second factor, "systematic concept formation," when the same stimulus dimensions are relevant across the total set of concepts.

Metzger's suggestion that concept learning tasks lead to response interference implies a compounding of the stimuli prior to learning associations between stimuli and responses. "Systematic concept formation" in systematic concept tasks is seen as taking place after stimuli are compounded, and facilitates the learning of associations. The direction of the non-significant difference between the rote task and systematic concept task means obtained in Metzger's study would support such an interpretation (i.e., the rote task was completed more quickly than the systematic concept task).

However, results obtained by Smith, Jones, and Thomas (1964) lead to a somewhat different interpretation. They found that performance on a systematic concept task was superior to that in a rote task, though the rote task produced significantly better performances than the unsystematic concept task. Smith, et al.'s study differed in two important ways from Metzger's (1958). First, the only dimension on which stimuli varied was color. In the systematic concept task the stimuli having a common response were of similar hues. Thus, primary stimulus generalization in the systematic concept task may have been the critical facilitator of learning. An additional difference between the Smith, et al., and Metzger studies was the stimulus pacing procedure. Metzger utilized a 2:2 rate of presentation, while Smith, et al., allowed S to pace the stimulus presentations. While this pacing difference may not be the critical difference in the two studies that lead to the differing results, it does reveal the possibility that Metzger's rapid pacing may not have allowed Ss sufficient opportunity for mediation based on stimulus

dimensions, which seems to be what Metzger refers to as "systematic concept formation." If his rapid pacing procedure inhibited dimensional mediation, it is possible that Metzger's interpretation of concept tasks entailing response interference is somewhat incorrect.

A study by Sanders (1970) implies that stimulus compounding, and the resultant response interference, is not involved in the concept task learning of some Ss, and that Metzger's "systematic concept formation" is more accurately interpreted as an alternative process to stimulus compounding in concept learning. Sanders studied transfer of learning from systematic concept tasks to unsystematic concept tasks, and vice versa, and he did allow the Ss to pace the stimulus presentation themselves. In an attempt to explain the particular results he obtained, he correlated performances on the first task with performances on the second task and found differential transfer between the two transfer conditions. His interpretation involved postulating individual differences in preference for and skill in rote learning processes (stimulus compounding) and concept learning processes (systematic concept formation). If individuals do differ in these ways, an S utilizing dimensional mediation, or systematic concept formation,in a systematic concept task should not experience the response interference resulting from stimulus compounding. Any learner in an unsystematic concept task should learn more slowly since stimulus compounding is necessary, but the learner with a tendency to utilize systematic concept formation should experience the greatest difficulty since systematic concept formation would not lead to a completion of the task.

This discussion of the differences between processes required in rote, systematic concept, and unsystematic concept tasks leads to specific

predictions concerning the learning outcomes in the three types of tasks. Also, the postulation of individual differences implies that learner characteristics will relate differentially to learning in the tasks. When rote learning processes are involved and the stimulus components are compounded, the learner should be able to distinguish accurately between the stimuli for which he has learned responses and other very similar stimuli that were not a part of the learning task. Conceptual learning, on the other hand, would result in generalization of the learned responses to the new but similar stimuli based on the concept relevant attributes, and therefore, would adversely affect the accurate discrimination of previously presented versus new stimuli.

Three kinds of learner differences may be important concommitants of this difference between rote and conceptual processes. Individuals may differ with regard to their skill in rote learning and their skill in systematic concept formation. Learners may also differ in the extent to which they will utilize one or the other set of processes when the task may be learned either way or when it is unclear from information given which process is appropriate. Therefore, if process differences can be demonstrated in different tasks, differences among learners in rote skills, concept skills, and preferences for rote or concept learning should affect learning in predictable ways.

Learner preference for systematic concept learning should (1) facilitate performance in systematic concept tasks, since that tendency would avoid response interference, (2) inhibit performance in concept tasks in which no single set of dimensional mediators are appropriate, since a rote learning process - stimulus compounding - is the appropriate process, and (3) be unrelated to performance in tasks in which rote

learning processes are clearly appropriate. Systematic concept formation skills should (1) facilitate performance in systematic concept tasks, (2) be unrelated to performance in concept tasks in which no single set of dimensional mediators are appropriate, and (3) be unrelated to performance in tasks in which rote learning processes are clearly appropriate. Finally, rote skills may facilitate performance in any of the above tasks, though these skills are predicted to contribute more to performance in tasks in which rote learning processes are clearly appropriate since other learner differences may override the rote skills effects in the two types of concept tasks.

Experimental validation of the process and learner difference predictions made above would imply that rote, or Type I, transformations and conceptual, or Type II, transformations are distinct processes, with neither one basic to the other.

Method

Subjects

Fifty college students enrolled in an introductory educational psychology course volunteered for participation in the experiment, in order to receive additional credits toward their grade in the course.

Research Design

Subjects were individually administered three individual difference measures, followed by one of three experimental tasks. After criterion performance on the experimental task, Ss were asked to distinguish between stimuli used in the experimental task and other similar stimuli. The meterials and procedures for each of the tasks in the order of administration is described in detail in the following parts of the Method

section. For each S all tasks were presented during one session, requiring from 60 to 75 minutes.

The Ss were assigned to one of six conditions in alternating fashion in the order in which they appeared for the session. The six conditions are defined by two orthogonal dimensions. The main dimension is the type of experimental task: systematic concept learning, unsystematic concept learning, and rote learning. The other dimension is defined by two different orders of administration of the individual difference measures, and was designed to determine whether there was a contaminating effect of the individual difference measure presented immediately before the experimental treatment.

Materials, Tasks, and Procedures

Individual difference measures I. After a general introduction which indicated that there would be several tasks administered during the session, all Ss worked on a task designed to measure preference for conceptual learning.

The materials used for this task included an 11" by 18" cardboard, divided by lines into a four by four set of equal size rectangles. In each rectangle was the letter A, B, D, or E. Each letter was used in four rectangles, though the form of the letter was not the same in any two rectangles; form of the letters differed in case (lower or upper) and in print (script or block). These letters served as labels for sixteen 2½" by 3" cards, on which there was a square, diamond, triangle or circle. The geometrical forms varied from card to card in size (with sides of about 1½" or ½") and color (black or white) so that no two cards had objects that were exactly the same. The sixteen objects were assigned to one of the letter labels on the board by making the four combinations

of object size and color dimensions correlate perfectly with the letters (e.g., small, white object were assigned E labels). The labels were arranged on the board so that when the object cards were placed over their appropriate letter labels, the array of cards was not ordered on any object dimension or combination of dimensions. The arrangement of stimuli and labels is drawn in Figure 1.

The S was shown the board with the object cards placed over their appropriate letter labels so that the labels could not be seen. After a description of the ways in which the objects and labels varied, he was told that his task would be to learn which labels went with which objects. He was not told that any characteristics of the objects were related to any characteristics of the labels. Then the E allowed the S to uncover up to four labels to study for fifteen second periods. After twenty such study periods, the S was asked to recall which labels went with which objects.

Scoring for this task was based on the pattern of study choices during the 20 fifteen second periods, not on the basis of recall. It was assumed that if a person preferred a concept learning orientation, he would select more than one object label to study at a time and that the objects selected would be similar to one another on some characteristic or characteristics. Since objects of similar characteristics did not often border one another on the board, the selections of the concept learner would be separated from one another. Therefore, each study period selection pattern was recorded and the S was given one point for each pattern manifesting the concept learner pattern described above. A high score on this measure indicates a concept learning preference.

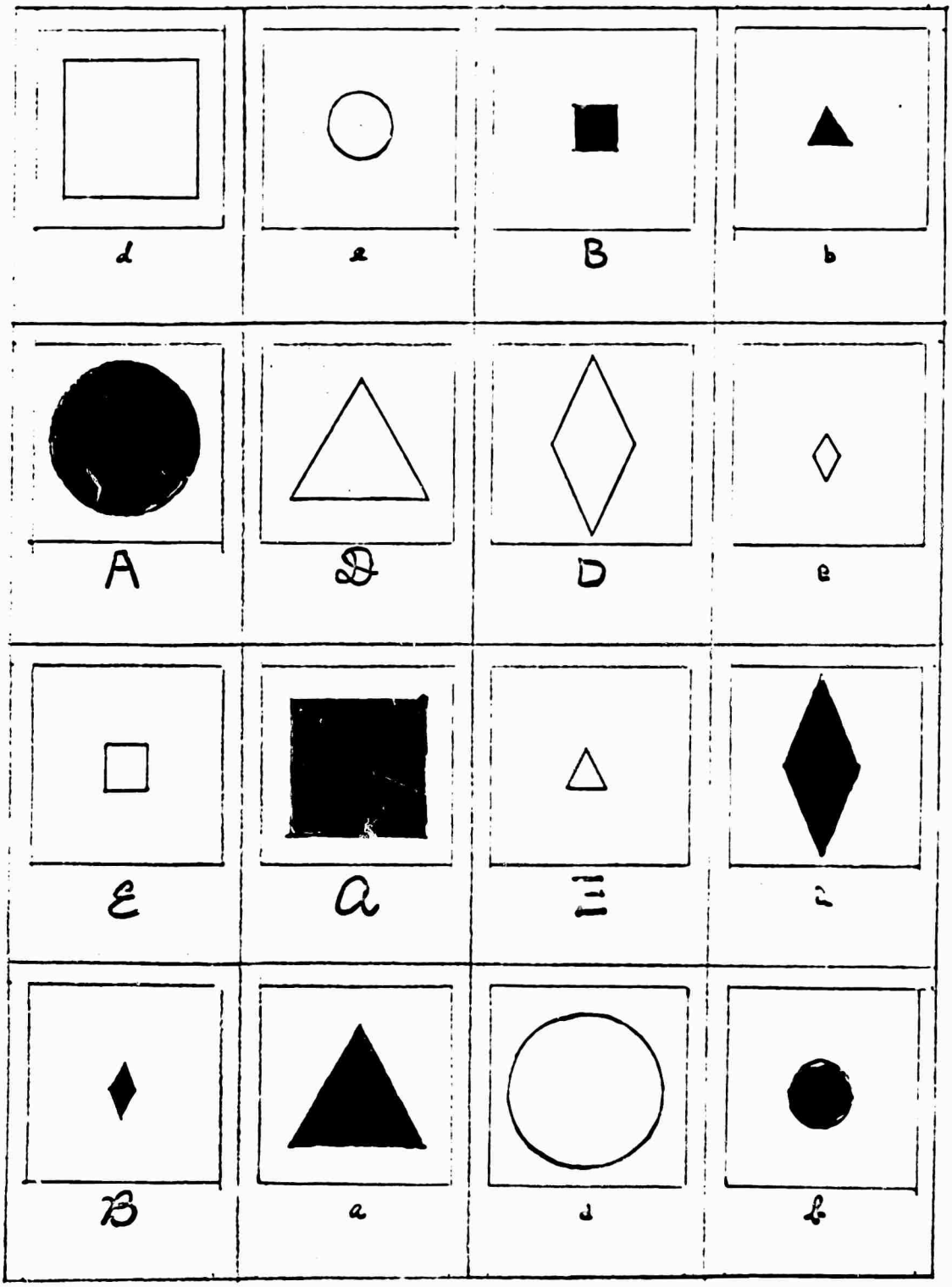

Figure 1. Arrangement of stimuli and letter labels used in preference for concept learning task.

Individual difference measures II and III. Following the preference task, Ss were given a rote skills task and a concept skills task. One-half of the Ss worked on the rote skills task first, while the other half took the concept skills task first.

The rote skills task involved remembering which of the numbers one through twelve were pair associated with strings of four G's, each string differing from the others by the sequence of capital and small letter G's (e.g., g G G g was paired with the number 1). Numbers were assigned randomly to the letter strings, and all pairs were presented simultaneously in numerical order on a piece of typing paper. The Ss were allowed three one-minute study periods, each followed by a one-minute test. Prior to the first study period, the S was not informed that there would be three study periods. The test required assignment of the numbers to the strings of letters presented on the test sheet. The test included two additional strings not present in the learning task, and the strings were listed in a different random order for each of the three tests. The sum of the pairs correct on each test was used to indicate skill in rote learning.

The concept skills task involved the use of sixteen stimuli, which were grouped into four sets of four stimuli each. The stimuli were strings of the letters N, O, P, and Q. The letters were always presented in N-O-P-Q order, but each string differed from all others by the particular sequence of upper case/lower case forms of the letters. The four groupings were defined by the case combinations of O and Q (e.g., all sequences with a capital O and a small Q were grouped together and all sequences with both O and Q capitalized were grouped together). Each stimulus was presented on a separate 3 x 5 card, and the group membership

of the stimulus was indicated by the color of 3 x 5 cards used (e.g., stimuli with O and Q both in lower case forms were presented on green 3 x 5's).

Stimuli were described for S and he was instructed that his task was to determine the basis for grouping. He attempted to learn the basis by selecting an instance of one of the groupings for study. For all selections after his third selection, S was required to verbalize his best guess as to the basis of the groupings before he could select another instance. The selection-study-hypothesis generation procedure was paced by E so that Ss could not spend longer than one minute per selection. The task was terminated the first time S expressed the bases for placing the stimuli in the four different groupings. The score on this task was number of selections before a correct hypothesis; thus, a low score indicates skill in concept learning.

Experimental task. Following the individual difference tasks the S was given a systematic concept learning task (SCT), an unsystematic concept learning task (UCT), or a rote learning task (RT).

In all three tasks the same eight stimuli were used. The stimuli were generated from characteristics of shape (square or diamond), color (red or blue), size (with sides of about three inches or about 1½ inches), and position (to the right or the left of a line that bisected the picture). Of the 16 stimuli involving all combinations of the above attributes, eight were selected so that no two stimuli had more than two attributes in common. The stimuli were projected from a Kodak Carousel projector to a wall. The S sat between and slightly to one side of the projector and the wall projection. The E sat beside the projector.

In the SCT, the eight stimuli were assigned number labels (one, two, three, or four) on the basis of the four combinations ot color and position attributes. The UCT involved grouping the eight stimuli so that there were no stimulus dimensions consistently relevant for the four response categories. The UCT groupings included two stimuli for each number (one, two, three, or four) response, and the relevant attributes for each grouping were as follows: (1) size (small) and shape (square), (2) size (large) and color (blue), (3) no attributes in common, and (4) color (red) and position (left). In the RT each stimulus was randomly assigned to its own number (one through eight). These three experimental tasks are defined as Metzger (1958) defined the four dimension tasks in his second experiment, though Metzger did not utilize the same stimuli as the present authors. The stimuli used and their labels for each type of task are presented in Appendix 1.

The E read the instructions which included a description of the dimensions of attributes of the stimuli, the number of stimuli for each number label response, and a description of the stimulus presentation and responding procedures. If S asked about the basis for assignment of number responses, E avoided answering by repeating that the task was to learn which number went with each stimulus. Stimuli were presented one at a time. When S gave his number response, E removed the slide and gave the feedback "Correct, that was a ____" or "No, that was a ____." When S was ready for the next stimulus, he indicated so verbally. This procedure continued until S had given the correct response for 15 stimuli in succession.

The stimuli were presented in a sequence that prevented stimuli of the same response label from appearing in immediate succession. The eight

stimuli were presented in five different subsequences; after the fifth subsequence, stimulus presentation began again with the first subsequence without interruption.

Recall task. After criterion performance was attained on the experimental task, Ss were told that they would be shown some slides of stimuli presented in the previous task and some new, but similar stimuli. Their task was to say whether they thought the slide had been presented in the preceding task, and if so, give the appropriate number label for that stimulus. The Ss were told that no feedback about correctness would be given during this stage of the experiment.

A total of 24 stimuli were presented, the presentation being paced by the S. Eight of the stimuli were the experimental task stimuli. The 16 additional stimuli involved two presentations of each of the eight stimuli not previously presented but which involved variations of the four dimensions used in the experimental stimuli. The order of presentation of the 24 stimuli was random.

The Ss' responses were used to determine four scores: (1) Correct positive recall: number of the eight previously presented stimuli that were correctly labeled. (2) Correct negative recall: number of the 16 new stimuli that were correctly identified as not being experimental task stimuli. (3) Stimulus generalization: number of the 16 new stimuli that were labeled in the same manner as one of the previously presented stimuli that had three attributes in common with the new stimulus. (4) Concept generalization: number of the 16 new stimuli that were labeled in the same manner as one of the previously presented stimuli that had the two concept relevant attributes in common with the new stimulus. (For those Ss in the RT condition, a concept generalization measure is

not appropriate. In analyses involving concept generalization, the stimulus generalization measure was used for those in the RT condition.) The labels that were scored as stimulus generalization and concept generalization are presented in Appendix 2.

Results

Prior to the analyses for predicted effects, the authors investigated the effects of order of presentation of skill tasks on experimental task performance in the three task conditions. When S was given the rote skills task immediately preceding the experimental task, he was classified as a 1; when he was given the concept skills task immediately before the experimental task, he was classified as a 2. Then classification was correlated with experimental task trials to criterion and the results were $r = .01$ in SCT, $r = -.29$ in UCT, and $r = -.08$ in RT. A comparison of the regression of skill order on experimental task performance in the three conditions resulted in an $F\ (2,44) = 0.40$. The overall effects of skill task order on skills task performances was also calculated, and resulted in $r = -.13$ for concept skills and $r = -.07$ for rote skills. The authors concluded that the effects of order of skills task administration did not require qualification of the other results of the study, and additional analyses were performed without regard to the order of presentation of skills tasks.

Results concerning process differences. A multivariate analysis of variance was calculated to determine differences among SCT, UCT, and RT conditions on the five dependent measures: (1) trials to criterion in the learning task, (2) correct positive recall, (3) correct negative recall, (4) stimulus generalization, and (5) concept generalization. The

analysis yielded a χ^2 (10) = 31.92, $p < .01$, indicating an overall difference among conditions (Morrison, 1967, p. 198). The relevant means and standard deviations are presented in Table 1.

Using a procedure for multivariate multiple comparisons described by Morrison (1967, pp. 182-185), comparisons were made for each of the five dependent measures. Table 2 presents the 95% simultaneous confidence intervals for the observed mean differences between the three pairs of learning conditions; if a difference of zero amount is not included within the interval, the interpretation is that the observed difference indicates a mean difference beyond the .05 level of significance.

Results concerning individual differences. In addition to making hypothesis concerning learning task effects, E predicted different relationships between specific dependent variables and individual differences in preference for and skill in rote and conceptual learning. Since the individual difference measures have not been studied previously, it is appropriate to present information concerning the reliabilities of these specially constructed measures before presenting the analyses related to predictions involving these measures. It was assumed that if the measures were reliable, they should manifest similar intercorrelations in the three conditions. Since Ss were assigned to the conditions in a fashion designed to equate initially the conditions, since Ss experienced no difference in condition treatments before they worked on the individual difference tasks, and since the conditions did not differ significantly on any of the individual difference measures, any difference in the correlations of individual difference measures among the three conditions would be the result of unreliability of measurement in one or both of the measures. Correlations of each of the three individual differences with

Table 1

Means and Standard Deviations for Five Dependent Variables in the Three Learning Task Conditions

Criteria		Learning Task		
		SCT (n=17)	UCT (n=16)	RT (n=17)
Trials to criterion	$\bar{X}$	61.8	128.9	75.6
	S_x	40.28	36.07	29.61
Correct positive recall	$\bar{X}$	6.2	6.7	6.9
	S_x	1.67	1.09	1.03
Correct negative recall	$\bar{X}$	8.9	13.6	15.1
	S_x	4.07	2.36	1.11
Stimulus generalization	$\bar{X}$	7.4	2.8	1.5
	S_x	3.79	2.20	0.72
Concept generalization	$\bar{X}$	6.1	1.8	1.5
	S_x	4.37	1.00	0.72

Table 2

The 95% Simultaneous Confidence Intervals for Observed Mean Differences on the Five Dependent Variables between Pairs of the Three Learning Conditions

Criteria	Learning Condition Means Being Compared		
	SCT - UCT	SCT - RT	UCT - RT
Trials to criterion	31.2 to 102.9*	-20.3 to 50.2	16.3 to 87.9*
Correct positive recall	-0.9 to 1.8	-0.6 to 2.0	-1.1 to 1.6
Correct negative recall	1.7 to 7.5*	3.3 to 9.0*	-1.3 to 4.4
Stimulus generalization	1.6 to 7.1*	2.0 to 7.3*	-2.4 to 3.0
Concept generalization	1.9 to 7.2*	3.3 to 8.5*	-1.3 to 4.0

* $p < .05$

one another for each treatment condition are presented in Table 3. The marked fluctuations in correlations indicates that at least two of the individual difference measures probably lack sufficient reliability to correlate significantly with other measures. Therefore, the following analyses of predicted relationships should be read for information about the usefulness of the individual difference measures in addition to the concern for differential relationships of the individual differences in the different learning conditions.

Hypotheses concerning predicted relationships of the individual differences and learning in the different learning tasks were tested by comparing the regression of each learner difference measure on trials to criterion in the three learning task conditions. The related correlation coefficients are reported in Table 4. The first hypothesis tested concerned learner difference in preference for concept learning. The preference measure did differentially relate to learning in the three learning task conditions (F (2,44) = 6.18, $p < .01$). However, further analysis indicated that preference did not significantly facilitate learning in SCT when compared with RT (F (1,30) = 0.86).

The second set of hypotheses concerned the relation of concept skills to performance in the learning tasks, and regression analysis revealed an overall difference among learning conditions (F (2,44) = 7.78, $p < .01$). However, the hypotheses concerning concept skills were not supported since those skills as measured were significantly related to performance in UCT ($r = -.70$, $p < .01$) and there was no difference in facilitative effects of the skills between SCT and RT (F (1,30) = 0.68).

Finally, rote skills as measured were not differentially related to performance in the three learning tasks (F (2,44) = 1.02, $p > .05$).

Table 3

Information concerning the Reliability of the Three Individual Difference Measures: Intercorrelations of the Individual Difference Measures in the Three Learning Task Conditions

Measures Correlated	Learning Task Conditions			Overall
	SCT (n=17)	UCT (n=16)	RT (n=17)	(N=50)
Preference for concept learning and concept skills	-.83†	-.68†	-.38	-.53†
Preference for concept learning and rote skills	.59*	.33	-.29	.08
Concept skills and rote skills	-.58*	-.53*	.14	-.22

* $p < .05$

† $p < .01$

Table 4

Correlations between the Three Individual Difference Measures and Trials to Criterion in the Three Learning Conditions

Individual Differences	Learning Conditions		
	SCT	UCT	RT
Preference for concept learning	-.41	.63†	-.18
Concept skills	.44	-.70†	.24
Rote skills	-.27	.12	-.36

† $p < .01$

Note: $r_{.05} = .48$

Further analysis of the differences between UCT and RT also resulted in no significant differences (F (1,29) = 1.72, p > .05).

Discussion

The differences in learning in the three types of learning tasks are in essential agreement with Metzger's (1958) results, though the non-significant difference between rote learning and systematic concept learning were in the opposite direction from that observed by Metzger and were in the same direction as those observed by Smith, Jones, and Thomas (1964). Taken together the two previous studies and the present one establish with quite differing materials and procedures that learning a set of concepts having different relevant dimensions (UCT) is much more difficult than learning to classify objects on the basis of common relevant dimensions (SCT) or learning to label each object individually (RT).

The present study also included a procedure for revealing particular differences in what is learned in the three types of tasks. After Ss had demonstrated that the appropriate responses had been learned for each of the stimuli, they were asked to distinguish between the stimuli for which they had learned responses and other stimuli that were not a part of the learning task. The present authors reasoned that rote task learning would result in accurate discriminations between the new and old stimuli, but that those Ss who learned the set of concepts having common relevant dimensions (SCT) would make errors by generalizing the relevant dimensions to the new stimuli. These predictions were confirmed. The difference between RT and SCT Ss in accurate distinctions between previously presented stimuli and new, similar stimuli supports the view

that a stimulus compounding process required in a rote task is not necessary in a systematic concept task. The related errors in these distinctions made by Ss in the SCT were concept generalization errors, which is interpreted to indicate that the concept learning process tends to lead to an elimination from memory of the irrelevant attributes of objects or events. The profile of correct negative recall and generalization scores of Ss in the UCT condition indicates that these Ss learned through essentially the same process of stimulus compounding that the RT Ss used.

The present authors also predicted that process differences among the three types of tasks allowed for the possibility that the learner characteristics important in one type of task would have a different relevance or no importance at all in the other task types.

First, it was predicted that learner preference for systematic concept learning should facilitate performance in the systematic concept task (SCT), inhibit performance in the concept task in which rote processes were appropriate (UCT), and be unrelated to rote task learning (RT). While the latter two predictions were confirmed, the preference measure was not significantly more related to performances in the SCT than in the RT, though the correlation values were in the appropriate directions (see the first row of values in Table 4).

The second set of individual difference predictions concerned skill in systematic concept learning. Concept skill was predicted to be positively related to performance in SCT and unrelated to performance in UCT and RT. The predictions were not confirmed, and the significant negative relationship between this skill as measured and performance in the UCT is difficult for the present authors to conceptualize. The

pattern of relationships of this variable to performance in the three learning tasks is so similar to those involving preference for concept learning that the only reliable factor in the skills measure may have been preference for concept learning. Such would have been the case if the instructions to the skills task had been ambiguous, and Ss did express considerable confusion in this task.

The third set of individual difference predictions were about relationships of skill in rote learning and performance in the three learning tasks. The relevant analyses indicated no relationship of rote skills to any of the three tasks. A difference in administration procedures between the skills task and the learning tasks may have reduced the underlying relationships between skill and performance in the learning task. The skills task was definitely speeded and no S remembered more than eight correct responses for the twelve stimuli during any one of the three exposures. By contrast, the learning tasks were paced by the S. Thus, it is possible that the lack of significant, supporting findings here were the result of this procedural difference.

Because the individual difference measures are not fully developed, the conclusions based on these findings must be more tentative than those concerning process differences. However, the differential relationships between preference for concept learning and learning in the three types of tasks supports the view that the process difference between rote and concept learning is paralleled by a learner difference in the tendency to utilize the different processes. The process differences as described and the results using the individual difference measure of preference for systematic concept formation would imply that the two processes (Type I and Type II transformations in Di Vesta, 1970) are somewhat independent of one another, with neither one basic to the other.

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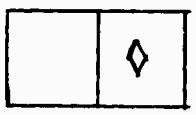
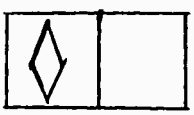
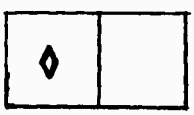
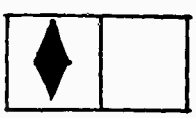
Appendix 1

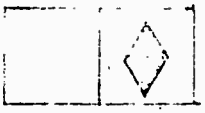
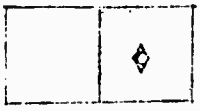
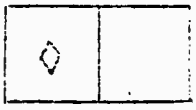
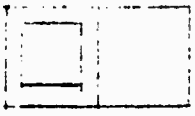
Response Labels for the Eight Stimuli Used in the Three Learning Tasks

Stimuli[1]	Label in Systematic Concept Task	Label in Unsystematic Concept Task	Label in Rote Task
	1	1	3
	1	3	4
	2	4	7
	2	4	1
	3	3	2
	3	2	8
	4	1	5
	4	2	6

[1] Outlined objects were red and solid objects were blue.

Appendix 2

Stimulus Generalization and Concept Generalization Scoring of Labels for New Stimuli in the Post-Learning Test

Stimuli[1]	Labels in Stimulus generalization for			Concept generalization for		
	SCT	UCT	RT	SCT	UCT	RT
	3 or 4	2	6 or 8	4	2	6 or 8
	1 or 4	1 or 3	4 or 5	4	1	4 or 5
	3 or 4	1 or 3	2 or 5	3	1	2 or 5
	2 or 3	2 or 4	1 or 8	3	1	1 or 8
	1 or 2	1 or 4	1 or 3	2	4	1 or 3
	2 or 3	3 or 4	2 or 7	2	1 or 4	2 or 7
	1 or 2	3 or 4	4 or 7	1	4	4 or 7
	1 or 4	1 or 2	3 or 6	1	1	3 or 6

[1] Outlined objects were red and solid objects were blue.

Summary

The Effects of Note-taking and Rate of Presentation on Short-term Objective Test Performance

Donald L. Peters

Technical Problem

This study investigated both the effects of note-taking and the rate of presentation on immediate objective test performance. Previous research had yielded conflicting results concerning the value of note-taking to the student. This study hypothesized that some of the confusion could be attributed to lack of control over the rate of presentation of the material. Additionally, an attempt was made to isolate listening effects from other information processing steps and to determine the effects of individual differences on listening skills.

General Methodology

A study was conducted which manipulated rate and type of presentation as well as note-taking to yield six experimental conditions. Subjects were randomly assigned to treatments and individually administered several individual difference measures thought to be related to listening efficiency. The subjects were then administered one of the six treatments and post-tested by means of an objective test.

Technical Results

A three way analysis of variance indicated a significant main effect due to the manipulation of the note-taking instructions with significantly

more correct responses on the criterion test being recorded by subjects not engaged in note-taking. Regression analyses uncovered several aptitude/treatment interactions suggesting that low efficiency listeners performed better when material was presented at slower rates and when they were not engaged in taking notes.

Educational Implications

The results indicate that note-taking activity on the part of students may have a significantly negative effect on performance. Further, this effect seems to be most important to subjects who have less efficient information processing skills.

Implications for Further Research

This study suggests that specification of the type of materials used, the rate of auditory stimulus presentation, and the individual characteristics of the learner are all necessary for an analysis of the utility of note-taking behavior. Further, the data suggest that other processes besides listening are affected by note-taking. Systematic investigation to determine what those processes are, and how they are affected would seem particularly profitable.

The Effects of Note-taking and Rate of Presentation on Short-term Objective Test Performance

Donald L. Peters

Although note-taking is advocated by most teachers, some students contend that taking notes during a lecture hampers their listening comprehension. The students maintain that while they are busy writing down one point, they do not hear others. Surprisingly, there has been little systematic effort to determine whether or not the student instrumental activity of note-taking actually improves performance as measured in subsequent testing situations.

The few studies dealing with the effects of note-taking on recall offer only mixed support for the value of this activity. Pauk (1963), for example, found no differences on immediate recall between subjects who took notes and those who did not. Eisner and Rohde (1959) found no differences in performance the following day between subjects who took notes during a presentation and those who took notes following the presentation. Both groups were permitted to study their notes during the interim between the presentation and the testing. McClendon (1956) reports no significant differences in either immediate or delayed recall between those students who took notes and those who did not.

Crawford (1925) and McHenry (1969) do report significant differences favoring note-takers on true-false and multiple-choice tests administered immediately following a study period. McHenry found all three of his

note-taking treatments (copious, abbreviated, and fact-principle) had a significant effect. All three groups scored higher than a no-note control group on a multiple-choice listening comprehension measure. Peters and Harris (1970) also indicate that subjects permitted to take notes during a taped presentation, or who were provided with prepared notes in topical outline form, performed significantly better on a subsequent multiple-choice test than a no-note control group whether or not time was provided for review. No significant performance differences were found between the note-takers and those provided with the prepared notes.

One variable that has been either experimentally controlled or allowed to vary randomly in the above studies is the rate at which the material was presented to the subjects. It would seem reasonable that a sharp increase in the rate of presentation would decrease the benefits accrued from taking notes. That is, taking notes during a very rapid presentation may interfere with listening while at slower speeds it may enhance listening by increasing the concentration of the student. This would suggest that there would be a cross-over rate at which note-taking would make no difference in performance. A relationship of this sort would help to explain some of the conflicting results appearing in the note-taking literature.

The question then arises as to where the cross-over might occur. Although no research has been directed to this question, one might venture the guess that it would fall within the range of the normal rate of speech. A variety of suggestions have been made concerning what constitutes a normal rate of speech. Johnson (1966) states that the standard rate of radio speech is from 150-225 words per minute (wpm). Nichols and Stevens (1967) suggest that the normal conversation rate is approximately 125 wpm.

Oliver, Zelko, and Holtzman (1966) state that the average person speaks at a rate of 125-160 wpm, while Taylor (1964) suggests 135-175 for the average. The consensus seems to be that the normal rate of speech is between 125-200 wpm.

Several studies (Nelson, 1948; Goldstein, 1940; Fairbanks, Guttman, and Miron, 1957; Jester, 1966; Orr, Friedman and Graae, 1970) have examined the effect of rate of presentation on the performance of adult subjects. In these studies comprehension, as measured by multiple-choice tests, appears not to be significantly affected until very high rates (that is, 300 wpm or more) are reached. However, in these studies no notes were taken by the subjects.

Research in the area of note-taking and its effects on listening has seldom taken individual differences of the learner into account. Peters and Harris (1970) investigated the effects of several global learner personality variables on performance with disappointing results. Of several possible interactions, only one was found to reach an acceptable level of significance. Subjects scoring low (tolerant) on a measure of intolerance for ambiguity (Budner, 1963) demonstrated inferior learning when not permitted to take notes whereas subjects scoring high on this measure showed no differences in performance whether or not they were permitted to take notes.

A more promising area of search for the interaction of individual differences with learning conditions is to look at variables closely related and relevant to the demands of the learning situation. Where presentation rates are varied, two such variables might include the individual learner's own rate of speech and his listening efficiency.

The purpose of the present research was to determine: the effect of note-taking on listening efficiency as measured by an immediate objective test of learning; the effect of variations in the rate of presentation; and, the possible interaction of the two. Additionally, an attempt was made to determine if the effects could be isolated as listening effects rather than as facilitation of or interference with some later aspect of the information processing cycle. Lastly, the effects of aptitude by treatment interactions on performance were investigated utilizing aptitude variables thought to be closely related to the learning situation. The two variables selected were listening efficiency and oral reading rate. Both were thought to be reflective of the rate of information processing of the individual and hence to be related to the independent variables of the present study.

Method

Subjects

Eighty-two undergraduate students enrolled in an introductory educational psychology course served as subjects for the study. Their participation earned them points toward their course grade.

Materials

Fifty social-psychological terms appearing in Kretch, Crutchfield, and Ballachey (1962) were randomly sorted into three lists, as follows: List A was comprised of 20 definitions and included a total of 436 words with the terms and their definitions ranging in length from 13 to 32 words; List B was also comprised of 20 other definitions and included 433 words with individual items ranging in length from 12 to 31 words; List C

was comprised of 10 definitions and included 190 words with items ranging from 10 to 28 words. An example of a term from List A is: "Mores - a class of norms which specify proper behavior in standard behavior events of vital importance to the members of society." The terms used on each list are provided in Table 1.

List A was recorded at 130 wpm with the mean duration per item of 10.1 seconds. List B was recorded at 192 wpm with the mean duration of items being 6.75 seconds. (Note that lists were confounded with rate of presentation.)

A 1613 word passage of scientific material, "Steel as an Alloy," adapted from Ausubel (1963), was also recorded at two rates. The "normal" rate was 146 wpm and the "fast" rate was 202 wpm.

A 150 word non-technical passage dealing with modification of social behavior was developed to provide a controlled stimulus for assessing the subject's usual oral reading rate (ORR).

Procedure

The subjects were randomly assigned to one of four listening conditions: 1) the passage was presented at a normal rate but the subject was not permitted to take notes; 2) the passage was presented at a normal rate and the subject was permitted to take notes; 3) the passage was presented at a fast rate and the subject was not permitted to take notes; 4) the passage was presented at a fast rate and the subject was permitted to take notes; or, 5) the subject was assigned to one of two reading conditions, one in which he could take notes and the other in which note-taking was not permitted.[1] The subjects who read the material were allotted a time period equivalent to that of the "fast" listening group.

Table 1

Social-psychological Terms Used in Assessment of Listening Efficiency

Test A		Test B	
Source List A	Term	Source List B	Term
1	Marginal Man		Neutral Region
2	Role Conflict		Role Incompatibility
3	Net Connectivity		Communication Net
4	Leader		Group Structure
5	Group Ideology		Core Culture
6	Cultural Premises		Withdrawal
7	Status		Substitute Goal
8	Repression		Mental Set
9	Autism		Need
10	Prestige Want		Cognitive Interconnectedness
11	Span of Apprehension		Adaptation Level
12	Cognitive Multiplexity		Prejudice
13	Assimilation		General Persuasibility
14	Ethnocentrism		Language
15	Pluralistic Ignorance		Status Discrepancy
16	Communication		Position
17	Connotative Meaning		Counter-conformity
18	Anticipatory Socialization		Folkways
19	Autokenetic Phenomenon		Regression
20	Mores		Denotative Meaning

(cont'd)

Table 1 (cont'd)

Social-psychological Terms Used in Assessment of Listening Efficiency

Test A		Test B	
Source List C	Term	Source List C	Term
21	Balance Theory		Causal System
22	Halo Effect		Membership Group
23	Projection		Cognitive Dissonance
24	Unidimensional Scale		Attitude Constellation
25	Pseudocommunication		Reaction Formation

The subjects were administered the procedures individually with the taped material presented via earphones. They were informed at the outset that the study was concerned with their performance on a series of listening tasks, that they would have to listen carefully, and that they would be tested on the material. The sequence of events was the same for all subjects: they first listened to List A and then were tested on Test A; they then listened to List B and then were tested on Test B; they were then administered the oral reading rate (ORR) test; they then listened to the taped lecture material; followed by the criterion test. The subjects in the note-taking treatments were told, prior to the lecture presentation, "You probably should take notes on the material on the paper I have provided." Those subjects who were in the treatments where notes were not permitted, were instructed, "Listen carefully." No mention was made of notes and no paper was provided the subjects who were in these treatments.

Measures

Listening efficiency. Following the taped presentation of each list of definitions, a fill-in test requiring recall of the terms was administered. Each Test A included twenty definitions from List A plus five definitions from List C as a control for prior learning. Test B included the twenty definitions from List B plus the remaining five definitions from List C. The reliabilities of the two tests were .54 and .70 respectively. The difference between the subject's scores on Tests A and B constituted his listening efficiency score.[2] The use of the difference score, while less reliable, permitted assessment of the subject's ability to process information under rapid presentation conditions adjusted for individual differences under normal presentation conditions.

Oral reading rate. The subject was requested to read aloud the 150 word passage of non-technical material. The time in seconds from start to completion constituted the measure for oral reading rate. The stability of the measure across two occasions during a single one-hour testing period was found to be .55 (N = 29).

Learning criterion. A 25-item, five-alternative multiple-choice test on the lecture material served as the criterion measure. The internal consistency reliability (K.R. 20) was .52.

Number of notes. For those treatments where notes were encouraged the notes were retained and a count was made of the number of words they contained as an index of the extensiveness of the note-taking activity.

Results

Initial Equivalence of Groups

No significant differences at the .05 level were found among the six groups for the scores on tests A or B, or for the ORR measure. Nor did the groups differ on the items from List C (parts of tests A and B). For those conditions where notes were encouraged, no significant differences among treatments were found in the extensiveness of notes taken. No sex differences were found on any of the above variables. As a result of these analyses the groups were assumed to be equivalent.

Effects of Note-taking and Rate of Presentation

Of central concern in this study was the question of the effects on the learning criteria of taking notes, variations in the presentation of the material, and the interaction of the two. Table 2 presents the results of a three way analysis of variance (Notes x Presentation x Sex)

Table 2

Analysis of Variance of Multiple-Choice Learning Criterion Scores

Source of Variance	df	Mean Squares	F Ratio
Notes	1	29.93	3.12*
Presentation	2	17.23	1.80
Sex	1	21.13	2.21
Notes x Presentation	2	2.32	0.24
Notes x Sex	1	0.22	0.02
Presentation x Sex	2	18.73	1.95
Notes x Presentation x Sex	2	2.47	0.26
Error	70	9.58	

* $p < .05$

with unequal cell sizes. The analysis yielded F (1,70) = 3.12, $p < .05$ for the main effect due to note-taking. Significantly more correct responses to the criterion test were made by subjects who were not engaged in taking notes. None of the other sources of variance were found to have significant effects ($p > .05$). All cell means are presented in Table 3.

Aptitude/treatment Interaction

To determine if differential learning took place as a result of the individual differences in learner aptitudes in the different treatments, the criterion test scores of the subjects were regressed on the aptitude scores (ORR, Test A, Test B and Listening Efficiency) separately by treatment conditions. A comparison was made of the slopes of the regression lines thus obtained from each aptitude criterion pair. This procedure indicated no significant differences in regression slopes when either the Test A score (based on listening to a passage presented at a normal rate) or the ORR measure were defined as the aptitude variables. However, when using the Test B score and the Listening Efficiency score as aptitudes, the analysis yielded F (5,70) = 5.34, $p < .001$; and F (5,70) = 4.74, $p < .01$, respectively, for differences in slope of the regression lines obtained by regressing the learning criterion scores on the aptitude scores. The correlations, regression coefficients, and intercepts obtained are presented in Tables 4 and 5.

In general, both interactions suggest that low scorers on the aptitude measures (low efficiency listeners) perform better when material was presented at a normal rate or read and when they were not engaged in taking notes. Note-taking appeared not to interfere with learning, nor to be advantageous for high aptitude scorers. This is illustrated in Figure 1

Table 3

Summary of Mean Test Scores Obtained by Males and Females in Each Experimental Treatment

Note-taking Treatment	Method of Presentation					
	Normal-Oral		Fast-Oral		Reading	
	Males	Females	Males	Females	Males	Females
No Notes	13.50	10.44	9.83	10.22	12.50	11.86
Notes	12.00	9.33	9.75	9.18	9.67	10.60

Table 4

Regression Analysis of Learning Criterion Scores on Test B Scores

Note-taking Treatment	Presentation Method: Normal-Oral			Fast-Oral			Read		
	r	Reg. Coef.	Int.	r	Reg. Coef.	Int.	r	Reg. Coef.	Int.
No Notes	-.43	-0.59	16.37	.55	0.43	6.62	-.61	-1.10	20.91
Notes	.61	0.60	5.06	.17	0.16	8.08	.27	0.32	7.86

Table 5

Regression Analysis of Learning Criterion Scores

on Listening Efficiency Scores

Note-taking Treatment	Presentation Method: Normal-Oral			Fast-Oral			Read		
	r	Reg. Coef.	Int.	r	Reg. Coef.	Int.	r	Reg. Coef.	Int.
No Notes	-.09	-0.12	12.94	.40	0.33	6.43	-.82	-1.85	33.76
Notes	-.01	-0.02	10.32	.14	0.11	8.15	.20	0.23	7.57

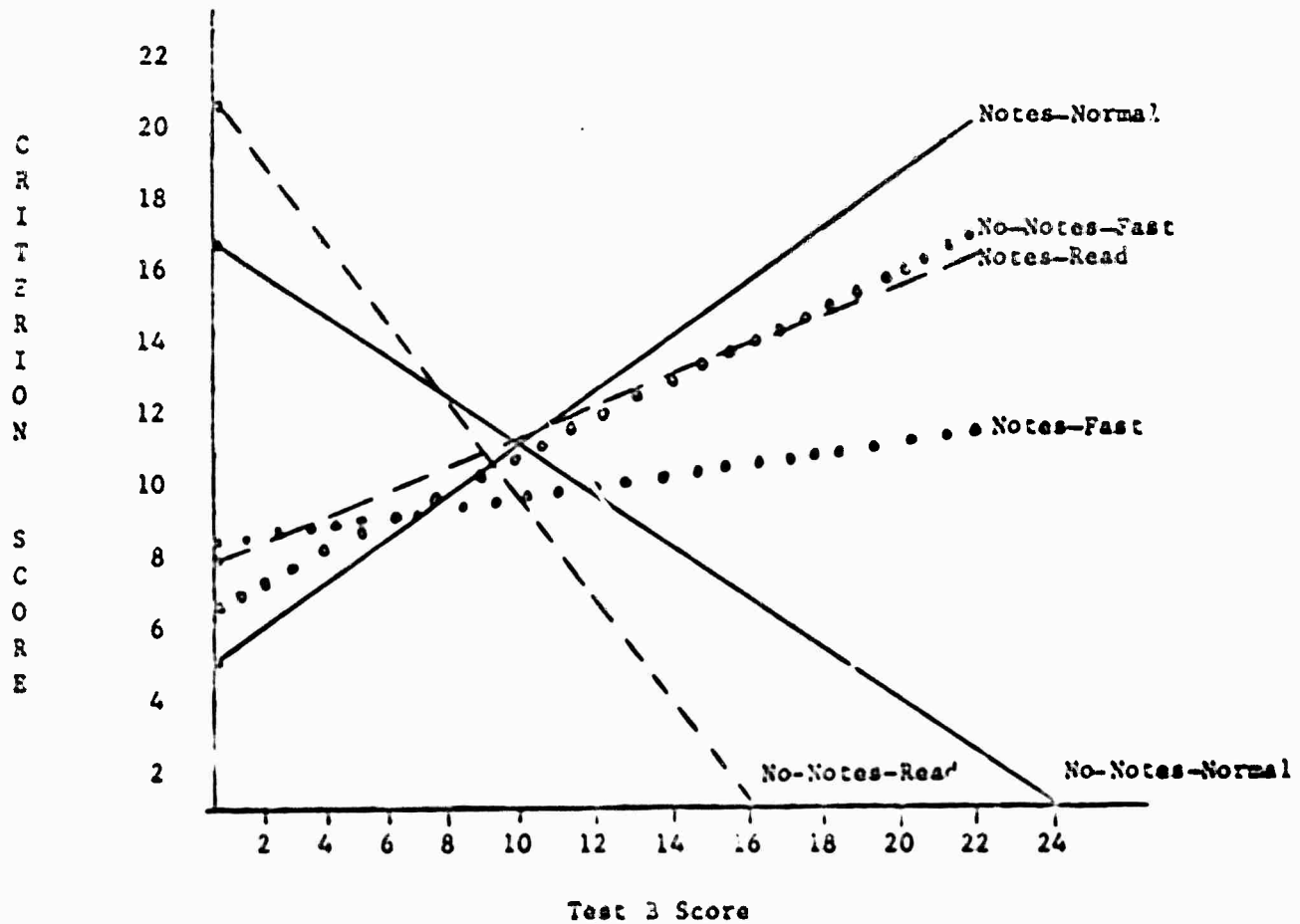


Figure 1. Regression of multiple-choice learning criterion scores on Test B aptitude scores for six treatment conditions.

which presents the regression lines for the six treatments utilizing the List B test score as the aptitude measure.

Discussion

One of the purposes of this research was to determine the effect of note-taking upon performance on an immediately administered multiple-choice test. Surprisingly, the results have indicated a deleterious effect of such activity. This is more consistent with the naive psychology of students than it is with the results of previous research. The latter suggested either no effect, or a facilitating effect for note-taking. Yet for all three presentation conditions in the present study the effect holds; though it was most marked for the slow taped presentation rate and for the reading conditions.

The results for the reading condition are most readily explained by the possibility that subjects who were not taking notes spent whatever extra time they had at their disposal to read the material more than once. For the subjects in the treatments where materials were presented at a "normal" rate of speed, an alternative explanation is suggested by the occasional doodles found on the notes. Thus, it is possible that the 146 wpm rate was too slow for some of the subjects. Since the material was not itself terribly interesting, the slower rate may have encouraged such non-facilitating behaviors as thinking of other things, fiddling with the pencil, and doodling. The faster rate (202 wpm) may have encouraged more attentive behavior.

The differences between the notes and no notes conditions for the "fast" taped presentations were not significantly different. This suggests the hypothesized "cross-over" point may be close to this presentation rate

value (that is, about 200 wpm). However, further research with different materials and more rapid presentation rates will be necessary to determine the accuracy of this suggestion.

That there were no significant differences across presentation variations raises the question as to whether or not note-taking actually affects listening behavior or information processing at some later point in time. That is, the present evidence sheds some doubt on the notion that the activity of note-taking interferes with the reception of the material. Rather, it seems that note-taking is an attention-directing activity which limits the amount of information processed whether it be presented orally or in written form. One could hypothesize that when the decision is made as to what to include in the notes, other information inputs are disregarded or not processed; whereas, when these decisions are not required, larger quantities of information are processed. If the information is presented slowly enough selection decisions probably are not necessary unless notes are to be taken. Only when the information input exceeds the limit where it can be processed entirely would some selection decision be needed whether or not notes are being taken.

The analysis of the aptitude/treatment interactions provides additional clarification of the relationships between rate, note-taking and the learner variables. The reader will recall that, overall, the taking of notes had a deleterious effect on performance. The effect was least evident in the efficient listeners (high scorers on Test B and difference measure Test A-Test B). This group might be more accurately called efficient information processors since the measures involved more factors than just listening. Having first gone through List A and the test on that list, the subjects were more aware of what was expected of them when presented with List B.

Although List B represented a more rapid presentation rate, the "efficient listeners" scored higher on the test for this list than they did on Test A. The "inefficient" listeners' scores on Test B fell below those of Test A. This improvement exhibited by the efficient learners reflects a more adaptive response for the requirements of the task, that is, they focused in on the terms themselves rather than on the details of the definitions etc.. In general, their selection of materials to be processed was more accurate than it was for the inefficient listeners. This probably also is true of their selection of materials for their notes, and under the fast presentation mode, their selection of material for processing when not taking notes. In the "fast presentation with notes permitted" condition the activity of note-taking may have interfered somewhat with the process.

These findings suggest that as hypothesized, there does exist a cross-over point in presentation rate before which note-taking facilitates acquisition of material and after which it has a deleterious effect. Furthermore, this point varies, depending upon the individual's information-processing efficiency. Specification of both the characteristics of the subjects and of the rates of presentation of the auditory stimuli would therefore seem essential if the contradictory findings of research on the effects of note-taking are to be understood. If as suggested earlier, different lecture material contents play a role in the value of note-taking, this variable too needs to be clearly specified. The effect of note-taking on performance is more complex than was suggested in previous research and has unrealized possibilities in understanding the variables that effect meaningful learning.

Notes

1. It should be noted that the random assignment of subjects to treatments was separate for the listening and reading conditions, though both samples were drawn from the same population.
2. Note that since the order of presentation remained the same for Lists A and B, any order effect is confounded with the effect of rate.

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Summary

The Effects of Recall Mode and Recall Interval Expectancies on Note-taking and Recall

Paul D. Weener

Technical Problem

This study investigated the effects of different student expectancies on the recall of presented material and note-taking activity during study. The general hypothesis underlying this research is that the manner in which a student actively operates on visual stimulus materials is dependent on his expectancies of when and in what form the information will have to be retrieved.

General Methodology

An experiment was conducted in which six treatment groups were given different expectations about when and in what form some visually presented material would have to be recalled. The two expected recall intervals were "immediate" and "one-week delay." The three expected recall modes were multiple-choice, essay, and verbal summary. These two factors, completely crossed, determined the six experimental groups. Regardless of the expectation created, all subjects were given a multiple-choice and an essay test immediately following a thirty minute study period and again one week later. Note-taking was permitted during the study period.

Technical Results

Scores were obtained on the multiple-choice and essay test for both immediate and delayed recall. In addition, the number of words of notes taken during study were counted. No significant differences in mean scores were obtained for the three levels of the expected recall mode for the multiple-choice or essay test, immediate or delayed. There was a strong trend, but no significant differences, in the number of notes taken under the three conditions with the order of the means being multiple-choice, essay, and verbal presentation.

The expected recall interval effect produced significant differences on essay test performance and in amount of notes taken but no significant differences in multiple-choice test performance. The immediate recall expectancy resulted in higher scores on the essay test but fewer notes taken during study than were observed under the delayed recall expectancy.

Educational Implications

The results imply that the expectancy of regular periodic quizzes and recitation activities which require recall shortly after study would result in better recall learning. The inverse relationship between essay test performance and amount of notes taken implies that note-taking has little or negative value in situations in which the notes taken cannot be used in later review.

Implications for Future Research

Stronger test expectancy effects should be created and analyzed before concluding that the type of test expected has no influence on the amount recalled or the student's activity during study. The research should be expanded to situations in which review of notes is permitted and to situations in which material is auditorily presented.

The Effects of Recall Mode and Recall Interval Expectancies on Note-taking and Recall

Paul D. Weener

The manner in which a student actively operates on visual or auditory stimulus materials in an instructional setting is dependent on his expectancies of when and in what form the information will have to be retrieved. The learner can select from a variety of information processing strategies depending on his perception of the desired output. Some tasks require the learner to focus on isolated bits of information and to store the presented information for a very brief period of time. Simple rehearsal processes may be adequate to fulfill the requirements of such a task. On the other extreme, some tasks require the learner to focus on broad, integrative principles and to recall the material months or even years later. Such a task would seem to require active transformational and coding processes which are, as yet, not well understood.

Within instructional settings, teachers use various types of tests as criterion measures of learning. Multiple-choice tests, essay tests, and oral presentations are common criterion methods used in educational settings. It is likely that the type of learning measure used determines the students' study activities and the amount and organization of what is learned.

The learner's activities which intervene between the presentation of the instructional task and the student's performance on the criterion task

are assumed to be adaptive behaviors which are influenced by the learner's perception of the desired criterion performance. These intervening learner activities have been referred to as "instrumental behavior" (McKeachie, 1961), "mathemagenic activities" (Rothkopf, 1968), and "mediating processes" (Anderson, 1970).

Note-taking, verbalization, and response to test-like events are specific instrumental activities which have been studied. Berliner (1970) reviewed the experimental research on the effects of note-taking in instructional settings and concluded that the evidence "is not favorable regarding the utility of note-taking" (p. 2). Recent research by Di Vesta and Gray (1971) and Peters and Harris (1970) showed beneficial learning effects associated with note-taking activities in experimental instructional settings. McKeachie (1963) concluded a discussion about problem-solving and concept learning by saying that "verbalization can help the student identify the common elements in these situations and shorten the learning process" (p. 1121). Rothkopf (1966) and Frase (1968) have demonstrated that the position and types of questions in instructional texts influence the learner's recall performance.

The focus of the present study is on the effect of the expected type of test and the expected length of the interval between the presentation of the instructional material and the criterion test on (a) the type and amount of learning which occurs and (b) the learner's instrumental activities, specifically, his note-taking activities. It was hypothesized that the type of test expected influences both the amount of learning which occurs and the type of instrumental activity which the learner engages in during study. Furthermore, it was hypothesized that the expected interval between presentation of instructional material and recall would also influence learning and instrumental activities.

Method

Experimental Design

Three sources of variance were studied in a 3 x 2 x 2 analysis of variance design. The three sources of variance studied were expected recall mode, expected recall interval, and actual recall interval. The three expected recall modes were multiple-choice, essay, and verbal summary. The two expected recall intervals were immediate and one-week delay. These two factors, completely crossed, determined the six experimental groups. "Actual recall interval" was a within-groups factor with immediate and one-week delay as the two levels.

Subjects

The subjects were 105 students, 45 males and 60 females from the introductory Educational Psychology course at The Pennsylvania State University who received course credit for their participation in the experiment. The six experimental groups contained the following numbers of subjects: multiple-choice - immediate, 16; multiple-choice - delayed, 18; essay - immediate, 18; essay - delayed, 17; verbal summary - immediate, 19; verbal summary - delayed, 17.

Materials

The task material was a five-page passage dealing with the principles governing the development of species. The criterion task was a combination of 20 multiple-choice questions and three definitive essay questions. The multiple-choice test consisted of sentences taken directly from the task material with key words deleted and four alternatives from which to choose. The essay questions were rather specific, referring to the main ideas in the passage, e.g., "What are the two basic conditions ... necessary

for the evolution of distinct species'" The stimulus materials and criterion tasks were exactly the same for all treatment groups.

Procedure

Subjects were recruited and participated in groups of six. Each of the six subjects was assigned randomly to one of the six experimental conditions. The subjects were seated at a large table which was partitioned into six cubicles so that the subjects were separated from one another. In each cubicle was a pencil, a yellow pad for note-taking, the specific instruction sheet for that subject's treatment condition, and the "Origin of Species" task material.

After the subjects were seated the experimenter gave brief instructions to the effect that they would have two minutes to read the instructions and thirty minutes to study the task material. After answering questions, if any, the experimenter left the room and observed the subjects through a one-way mirror.

Each subject read the instruction sheet which corresponded to the treatment group to which he was assigned. Each set of instructions was basically the same in format, each differing only with respect to the type of criterion task and time delay to be anticipated by the subject. The three test conditions were described as follows: the multiple-choice test was described in terms of the word deletion procedure and the number of alternatives; the essay test was described as consisting of questions about the main principles and supporting factual evidence; the verbal summary instructions stated that the subject would be required to summarize the main principles and supporting factual evidence in a subsequent presentation to an individual who had not read the passage. All subjects were instructed that they could take notes on the material but that they

would not be permitted to use any notes during the test. The subjects' understanding of the key parts of the instructions was checked with three questions following the instructions.

At the end of the 30 minute study period the experimenter re-entered the room and collected the instruction sheets, test booklets, and any notes that the subjects had made. He then instructed the subjects that regardless of what the instructions had said, everyone was required to take a test at that time and that they would have 20 minutes to complete the test. The test consisted of twenty multiple-choice questions and three essay questions.

At the end of the 20 minute period, the experimenter returned and collected the test papers. At this time all subjects were reminded that they were required to return one week later to continue the experiment, and then released.

When the subjects returned one week later they were again seated in the same experimental room and given the same multiple-choice/essay test they had taken the week before. They were again given 20 minutes to complete the test. After they finished the test, they were given a brief post-experimental questionnaire which asked about the credibility of the experimental conditions and whether or not they had discussed the experiment with anyone.

Scoring

The score on the multiple-choice test and the essay test and the number of words of ntoes taken during the study period were the three criterion measures in this experiment. The score on the multiple-choice test was the number of correct responses. A scoring guide which listed the important parts of the answer to each essay question was used to

score the essay responses. One point was awarded for each statement in the answer which coincided with the answers provided by the scoring guide.

Results

Three dependent measures - multiple-choice test, essay test, and amount of notes taken - were analyzed to determine the effects of expected recall mode and expected recall interval on recall performance and activity during study. The means and standard deviations for the multiple-choice and essay tests for each of the twelve cells are presented in Table 1.

A 3 x 2 x 2 analysis of variance was carried out to test the effects of expected test mode and expected test interval on multiple-choice test performance and essay test performance. The three levels of the expected recall mode factor were multiple-choice, essay, and verbal presentation; the two levels of the expected recall interval factor were immediate and one-week delay; and the two levels of the actual recall interval factor, a within subjects factor, were immediate and one-week delay.

The analysis of the scores on the multiple-choice test indicated no significant main effects due to expected recall mode, $\underline{F} = .10$, or recall interval, $\underline{F} = .11$. The actual recall interval was significant, $\underline{F} = 13.86$, $\underline{p} < .01$, with greater recall on the immediate retest than on the one-week delayed retest. The interaction between expected recall mode and expected recall interval was the only significant interaction, $\underline{F} = 3.30$, $\underline{p} < .05$. A test on simple main effects yielded no significant differences for any simple effect comparison. An inspection of the cell means indicated that the interaction resulted from a reverse order of mean scores under the immediate test expectancy condition as compared to

Table 1

Means and Standard Deviations for Immediate and Delayed Recall Scores On Multiple-Choice and Essay Tests

		Expected Recall Interval							
		Immediate				Delayed			
		Actual Recall Interval							
Expected Recall Mode	Test	Immediate		Delayed		Immediate		Delayed	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Multiple-Choice	MC	12.0	3.2	11.3	3.0	12.6	2.9	11.2	3.0
	Essay	5.4	2.9	4.3	2.3	5.1	2.8	2.8	2.5
Essay	MC	13.2	2.5	71.9	3.3	11.9	2.7	10.2	2.8
	Essay	6.6	3.1	4.9	3.1	4.3	3.2	3.4	2.6
Verbal Presentation	MC	11.4	3.1	11.1	2.8	13.4	3.3	12.5	3.5
	Essay	5.5	2.9	4.1	3.0	4.4	2.4	3.2	2.1

the delayed test expectancy condition. In the immediate test expectancy condition the essay group was highest, multiple-choice next highest, and the verbal presentation group had the lowest score, but the order of the means is reversed under the delayed expectancy condition.

The analysis of the essay test results indicated no significant effect due to expected recall mode, $F = .45$, $p > .05$. The expected recall interval effect was significant, $F = 7.01$, $p < .01$, with the immediate test expectancy resulting in significantly higher scores than the one-week delayed test expectancy. The actual recall interval was also significant, $F = 36.6$, $p < .01$, with the immediate essay test scores significantly higher than the delayed essay test scores. None of the interactions were significant.

An analysis of the note-taking activity under the six different experimental conditions was performed. A 3 x 2 analysis of variance was carried out with expected recall mode and interval as the two factors and number of words of notes taken as the dependent measure. The means and standard deviations for amount of notes taken in each of the conditions is presented in Table 2. The main effect of expected recall mode was not significant, $F = 1.59$, $p > .05$, but the effect of expected recall interval was significant, $F = 18.4$, $p < .01$. The subjects in the delayed test expectancy condition took about twice as many words of notes ($\overline{X} = 180.1$) as the subjects in the immediate test expectancy group ($\overline{X} = 90.9$).

The two previous analyses indicate an inverse relationship between performance on the essay test and the amount of notes taken. The essay test analysis indicated better performance in the immediate test expectancy condition than in the delayed test expectancy condition, but the analysis of notes taken indicated that many more notes were taken in the delayed

Table 2

Means and Standard Deviations for Number of Words of Notes Taken Under Six Experimental Conditions

Expected Recall Mode	Expected Recall Interval			
	Immediate		Delayed	
	Mean	SD	Mean	SD
Multiple-Choice	62.2	75.3	156.2	163.1
Essay	97.4	96.0	174.0	104.0
Verbal Presentation	108.9	68.1	211.5	102.9

test expectancy conditions than in the immediate test expectancy conditions. The rank order correlation between cell means on the essay test and amount of notes taken is $\rho = -.86$ for both the immediate and delayed essay tests ($df = 4$, $p < .05$).

Discussion

It was hypothesized that the type of recall test expected would influence the amount learned and the type of instrumental activity in which the learner engages. This hypothesis was not supported. On both the essay test and multiple-choice test, no significant differences emerged among the three test expectancy conditions. There were also no significant differences among the three groups in the amount of notes taken, although there was a strong trend with more notes being taken in the verbal presentation expectancy condition than in the essay expectancy condition and more notes in the essay condition than in the multiple-choice condition. Although the mean differences were quite large, the great variability in amount of notes taken produced very large within cell variances which obscured the between group differences (see Table 2).

The findings do not offer support for the intuitive report of many students that the type of test used influences how they study and what they learn. It may very well be that the dynamics operating in a classroom setting which produce these intuitions were not operating in the experimental setting. The brief one sentence description in the instructions may not adequately create the strong expectancies which lead to the modification of information processing strategies which are presumed to operate in "real-life" instructional settings. Stronger test expectancy effects might be created by administering a series of short instructional

units with the different conditions determined by the type of test used after each instructional unit. A student's study behaviors may be shaped more by taking different types of tests than by simply being told that different types of tests will be administered.

It was also hypothesized that the expected interval between presentation of instructional material and the test would influence learning and instrumental activities. The effect of different expected recall intervals was manifest on both the essay test results and the amount of notes taken, but was not evident when a multiple-choice test was used as the criterion measure. Those groups expecting an immediate test scored significantly higher on the essay test but took fewer notes than the groups expecting a test one week later.

A simple explanation of the results of the expected interval conditions would be that the immediate test expectancy condition was more arousal-provoking than a condition in which recall would be required one week later. This arousal explanation would argue that a person would work harder and pay more attention to the relevant stimuli under the immediate test condition than under the delayed test expectancy. But the note-taking activity of the two groups seems to belie an arousal explanation of the observed effect. The subjects in the delayed conditions took approximately twice as many notes as subjects under the immediate expectancy condition. This one index of activity level during the study period indicated a much higher level of overt activity during the study period for those groups expecting a delayed recall when compared to the immediate expectancy groups.

Another explanation of the findings is that the delayed test expectancy leads to external storage behavior such as note-taking rather than active

internal processes of reorganization and assimilation, and that an immediate test expectancy leads to less note-taking but more active internal storage operations. External storage behaviors such as note-taking are most likely not an efficient information processing strategy when the externally stored information will not be available for later use, as was the case in this experiment.

The subjects in the delayed expectancy condition seem to provide for external storage by taking notes on the presented information, but they do not seem to engage in the appropriate covert organizational activities to make the information available for later retrieval. The subjects in the immediate expectancy group seem to engage in the more effective strategy of reorganizing the presented material so that it is more available for both immediate and delayed recall tasks.

The finding of non-significant differences on the multiple-choice test is consistent with this explanation as well. The types of covert processing activities posited for the immediate expectancy groups would be more important for later recall, essay test performance, than for recognition, multiple-choice test performance. The multiple-choice test used in this experiment required a simple replacement of the missing word in a sentence with one of four words provided, where the sentences were lifted directly from the text. Given the different task requirements, the hypothesized intervening activities would account for the observed results.

The findings of this research cannot be generalized to situations in which review of notes is permitted or to situations in which the stimulus material is spoken rather than written. The effects of the manipulated expectancies in these conditions requires further experimentation.

The implications for instruction must also be restricted to situations in which written material is presented and no review of notes is possible. In such cases however, the presented research provided evidence that the expectancy for immediate recall of presented information would result in greater learning. Thus, the expectancy of regular periodic quizzes and recitation activities which require recall shortly after studying would result in better recall learning. But the importance of such expectations for recognition learning can be questioned on the basis of the insignificant differences on the multiple-choice criterion measure.

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Summary

Listening and Note-taking: I

Francis J. Di Vesta and G. Susan Gray

Technical Problem

The effects of note-taking, in various combination with rehearsal and testing, on achievement and recall were investigated in this study. The problem was to determine whether note-taking functions as external storage or as a basis for transforming the material to be learned into a form suitable for storage. It was assumed that if the former were the case, note-taking should interfere with the student's accomplishment; if the latter were the case, note-taking should result in enhanced learning and retention when compared with appropriate control conditions. These notions involve questions of how to improve attention of students while listening, how to develop learning sets that encourage transformation of learning materials, and how to determine the level of transformation most appropriate for given objectives.

General Methodology

Subjects listened to three 5-minute passages. The experimental period for each was divided into three segments. One-half of the subjects were permitted to take notes and the other half were not allowed to do so. Immediately after listening to the passage, half of the subjects in the above groups were allowed to rehearse or review the material heard; the other half were prevented from reviewing the material by performing another task. In the third segment of the experimental session the subject

was administered a test on the subject matter of the passage or, if he was in the control condition, he was administered a test on another topic. At the conclusion of the experiment the subject was administered a free recall test and a multiple-choice test. (All subjects had been administered a battery of personality measures prior to the experiment. Within this battery were the social desirability scale and the dogmatism scale.)

Technical Results

There were more words generated and higher multiple-choice test scores when the study interval was used for review than when it was used for other activity. The number of ideas recalled was favorably influenced by each of the factors of note-taking, rehearsal, and testing. These factors did not interact with each other to influence acquisition. There were no significant effects due to position of passage in the set of passages. Post-hoc analyses yielded significant correlations between performance and the individual difference variables of anxiety and tolerance of ambiguity. A significant interaction between social desirability and note-taking was obtained.

Educational Implications

The results of this study imply that notes serve to put the material in a form for easy storage and retrieval, given certain objectives. However, the effects of note-taking appear to be most salient for people with high social desirability scores. This finding implies that subjects with this personality characteristic may be more sensitive to the instructor's (i.e., the experimenter's) objectives and in fact may be trying to please him but, in the course of doing so by taking notes,

also enjoy the by-products of higher achievement scores. In summary, the activities of note-taking, rehearsal, and test-taking are important learning devices for the facilitation of encoding material for storage. These activities, because they result in transformations also result in greater facility in retrieving the material learned. Test events increase the salience of certain ideas expressed in a communication and may clarify, for the student, the kind of transformations required. Review provides an opportunity for consolidating the information acquired. The consequences of these activities take the form of such observable outcomes as time spent at a task, energy expended, and number of ideas acquired.

Listening and Note-taking[1]

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Despite the relative lack of research on the topic of listening, it is readily apparent that one of the most prevalent "learning sets" for attempting to enhance one's recall of the content of a lecture is to take written transcriptions of the material presented. Notes appear to serve either or both of two functions. As an external storage mechanism (Miller, Galanter & Pribram, 1960) they can provide a resource for later study or reference by the learner. As an encoding mechanism they allow the learner to transcribe whatever subjective associations, inferences, and interpretations occurred to him while listening. In the extreme case, note-taking which is used solely for the purposes of external storage can only be incompatible with efficient learning. Such notes tend to be taken in mechanical fashion, they interfere with attention, and they may engender a feeling that the task has been accomplished (for the time being at least). If the learner feels that a "good set of notes" is the equivalent of studying he may bypass review, rehearsal, or the simplest of transformational encoding.

By our reasoning, the kind of note-taking which serves a role in encoding should be much more efficient than one used only for external storage purposes. The behavior of the student employing encoding or other transformational processes reflects a transaction between the learner and the material to be learned, that is, it assumes or suggests an active learner. In a sense, the learner has taken the initiative necessary to put the material into long term store; through encoding the learner has linked the material to his

existing cognitive structure ... he has made it meaningful. Prior to the conduct of this experiment we assumed that, without special training, most students used notes for external storage. Since this assumption was made with some hesitation it appeared that, from the point of view of programmatic research on instructional strategy, the first investigations should be of the effects of taking notes in naturalistic settings on learning and retention. If, on the one hand, note-taking is found to interfere with recall then investigations must be conducted on how best to improve attention without notes, and how to develop learning sets related to efficient listening behavior. On the other hand, if note-taking clearly is found to enhance learning and retention, investigations must be conducted to examine the conditions under which it facilitates learning, that is, when and how notes are to be taken.

The foregoing suggests the possibilities for research and application to instruction implied in a mini-theory of listening and note-taking. The objective in the present study was an initial step in what we hope will be a series of empirical investigations on study habits within the above framework. Specifically, the present study was conducted to determine the effect of note-taking, in conjunction with the opportunity to review the material learned, on later recall. In as much as prior research (Rothkopf & Bisbicos, 1967) has suggested that test-like events following a communication can affect later recall of the message, the effects of testing, as another variable, were also examined.

Method

Design

The subjects in this experiment listened to three five-minute passages. For each passage the overall procedure consisted of three segments: a

five-minute period in which the subjects listened to a recorded communication; a five-minute interval; and a three-minute testing period. Note-taking was manipulated in the listening segment. During this period half of the subjects were permitted to take notes while the message was being presented; the other half were not permitted to do so. Each of these two groups was further subdivided for the two treatments administered in the second interval during which the subject was either allowed to rehearse the communication (by using his notes, or by contemplating whatever he could remember of the message) or, the subject was prevented from rehearsing (by requiring him to work on a spatial relations test). The final subdivision of groups was made in the third segment of the procedure during which time half of the subjects within each of the groups mentioned above took a fill-in test on the material presented; the other half worked on a spatial relations test. This procedure was followed for each of three communications, only one of which was to be used for criterion purposes. At the conclusion of the experiment a free-recall and multiple-choice test were administered, in that order, on the contents of all passages. The results for each set of data on the criterion passages were analyzed via a 2 x 2 x 2 x 3 factorial analysis of variance with two levels of note-taking (notes and no-notes), two levels of rehearsal (rehearsal and no-rehearsal), two levels of testing (test and no-test), and the position (first, second, or third) of the criterion passage in the sequence of three communications.

Subjects

One-hundred and twenty subjects were assigned randomly to one of the 24 experimental conditions with the restriction than an equal number (n = 5) of subjects be run in each condition. The subjects received credit toward their final grades in the course for their participation. No subject had

participated previously in an experiment where connected discourse had been used.

Materials

A set of three five-minute passages on different topics (hair seals, bow porcelain, and Xenograde systems) was taped for use as the communication materials. Each passage contained five hundred words. The information on hair seals and bow porcelain was taken from the Encyclopedia Americana (1963). The passage on Xenograde Systems was edited from the first chapter of material on An Imaginary Scientific System devised by Merrill (see for example, Merrill 1965a and 1965b) for experimental purposes. All topics were sufficiently unique so as to be unknown to the subjects prior to the experiment. Since the beginning of each passage was marked on the recording tape, the order of presentation of the passages could be controlled by the experimenter. In those treatments where interpolated material was required, two spatial ability tests were administered to the subjects: Flags: A Test of Space Thinking (Thurstone & Jeffrey, 1966) and A Space Relations Test from the Differential Aptitude Test Battery (Bennett, Seashore, and Wesman, 1947).

Only the results of the passage with a meaningful underlying theme (that is, the passage on the Xenograde System) were scored. The material on bow porcelain and hair seals was not analyzed because they were used primarily as a vehicle for manipulating position of the Xenograde passage within a set of passages. Furthermore, an attempt to score the content contained in the two passages immediately indicated that the number of specifics such as dates, proper names, and esoteric labels made a criterion list of ideas unwieldy and the scoring unreliable.

A battery of five tests, each tapping a different personality variable, had been administered to all subjects in a testing session previous to and

independent of this experiment. Since these test scores were available they were used to investigate possible relationships between individual differences and performance on the tasks. The five tests were: the facilitating and debilitating anxiety subscales of the Achievement Anxiety Scale (Alpert and Haber, 1960); Intolerance of Ambiguity Scale (Budner, 1962); Social Desirability Scale (Crowne and Marlowe, 1964); The Dogmatism Scale (Rokeach, 1960); and The Internal-External Scale (locus of control) (Rotter, 1966).

Procedure

At least two and never more than four subjects participated in the experiment at one time. Each subject worked at an isolated station with barriers of masonite particle board between stations to prevent sharing of information. The number of subjects run at any one time was variable because, on occasion some subjects who were scheduled for a given period failed to appear for the experiment. No two subjects were ever run in the same treatment condition at any one time. All subjects were assigned to their respective treatments at random when they arrived at the laboratory.

After the subjects were seated at their stations the experimenter instructed them to read the instructions silently. Questions were quietly answered whenever assistance was required. The instructions stressed that each person would be doing something different during the experiment. All persons were informed that the experiment was designed to investigate how people learn new materials. Furthermore, all subjects were told beforehand that the experiment would consist of three passages each with a sequence of three segments plus a final test on the three topics. The subject was in the same experimental treatment for all passages.

When the first five-minute listening session was begun, the subjects in the note-taking treatment had been informed that they could take notes

on the passages being presented. The subjects in the listening-only (no-notes) treatment had been told only to listen to the passage. They were not permitted to take notes during that time.

When the presentation of the communication was completed the second five-minute interval began. The subjects who were in the rehearsal condition were instructed that they were to use the five minutes to review what they heard. The subjects in the no-rehearsal condition were told that they would spend the five minutes working on some other material. During this time the latter groups worked on the spatial relations test.

After the five-minute study period the final three-minute interval was begun. In the testing treatment the subjects were given the short fill-in test on the passage. The subjects in the no-testing treatment spent their time in this interval on the second spatial relations test. This procedure was repeated for each of the two remaining passages.

At the conclusion of the presentation of all passages the subject was asked to write down everything that he could remember about each of the passages. When the subject was finished with this task the experimenter then administered three eight-item multiple-choice tests, one for each of the passages. The entire experiment including the final examination required about one hour to administer.

Results

The free recall test was scored for number of words and number of ideas generated by each subject. The number of words generated was scored as sheer volume of recall. Words, including articles, were counted for this score. The number of ideas generated were judged by two raters against a master list of ideas in the original passage. Interscorer reliability for this measure, based on 20 scores, was .95 for the two scorers of the papers.

A third measure of the subject's performance was obtained from the number of correct items on the final eight question multiple-choice test. As noted in the procedure section, the first two measures were scored only for the passage on Xenograde Systems. Each set of data was analyzed via a 2 x 2 x 2 x 3 factorial analysis of variance in which the factors were note-taking, rehearsal, test events, and position of the passage in the series.

The analysis of number of words generated yielded F (1,96) = 3.77, p = .06 for the main effect due to the rehearsal treatment. When a five-minute study period followed the listening period, a larger number of words ($\bar{X}$ = 108.7) was produced than when the study interval was filled by activities unrelated to rehearsal of the passage ($\bar{X}$ = 92.3). This result suggests one influence of rehearsal, as a mathemagenic activity intervening between the initial learning session and the recall task, on one measure of output. None of the other sources of variance (either main effects or interactions) was significant in this analysis.

By themselves, the results of the first analysis do not indicate that achievement or retention is necessarily affected by mathemagenic behaviors. They indicate only that rehearsal prompts the individual to write "more." He may do so because the demand characteristics of the experiment have been made salient or because he has more knowledge about which he can write. With regard to this point, the number of ideas generated was possibly the most important measure employed in this experiment. It reflects both acquisition and retention of material from listening to the passage and is more exhaustive of the information acquired by the subject than are any of the other measures. The data related to this measure are summarized for each experimental condition in Table 1. The analysis of variance of these

Table 1

Mean Number of Ideas Recalled by Subjects

in Each Experimental Treatment

Treatment	Position in set	Rehearsal		No Rehearsal	
		Related Test	Unrelated Test	Related Test	Unrelated Test
Listening only (no notes)	1	13.0	11.0	8.6	8.6
	2	14.2	8.6	11.4	6.6
	3	12.4	13.2	12.2	7.2
Overall $\bar{X}$		13.2	10.9	10.7	7.5
Overall SD		3.2	5.1	3.1	3.9
Listening and Note-taking	1	14.2	13.2	11.6	9.2
	2	14.0	12.8	14.4	10.0
	3	11.2	10.6	13.0	9.8
Overall $\bar{X}$		13.1	12.2	13.0	9.7
Overall SD		3.3	4.4	4.0	3.4

date yielded F (1,96) = 3.87, p = .05 for the main effect due to note-taking; F (1,96) = 8.92, p = .004 for the effect due to rehearsal; and F (1,96) = 11.58, p = .001 for the effect due to test-like events. The effects of the position of the passage in the series and of the interactions were not found to be significant ($p > .05$). These results indicated that subjects who were permitted to take notes recalled significantly more ideas ($\bar{X}$ = 12.0) than did those subjects who were permitted only to listen ($\bar{X}$ = 10.6). The rehearsal period enhanced the ability of subjects to recall ideas ($\bar{X}$ = 12.4) when compared with a period of similar length filled with unrelated activities ($\bar{X}$ = 10.2). Finally, when the subjects had a test on the material immediately following the listening period their performance ($\bar{X}$ = 12.5) excelled those subjects who worked on another test ($\bar{X}$ = 10.1). These data imply that mathemagenic behaviors have relatively direct effects on acquisition. The lack of a significant effect due to position suggests that the experimental treatment failed to develop learning sets which we assumed would be acquired by our subjects over the three listening periods.

The scores on the multiple-choice test, given at the end of the experimental session, were analyzed in a manner similar to that employed for the previously described dependent measures. Only the F (1,96) = 8.99 for the main effect due to note-taking was significant (p = .003) in this analysis. The subjects who were permitted to take notes earned higher scores ($\bar{X}$ = 6.2) on the multiple-choice test than did those subjects who merely listened ($\bar{X}$ = 5.5). While the effect of note-taking is a reliable one, other effects may not have been isolated because the test was so short thereby decreasing its reliability and affecting the representativeness of sampling the content of the passage.

Correlations between the five personality variables and the dependent measure of number of ideas generated were calculated for all groups. The results of this analysis are summarized in Table 2, where significnat relationships are marked with asterisks. Post hoc analyses of two of these scales, Social Desirability and Dogmatism, were made to identify possible interactions with treatments. Preliminary inspection of the data in Table 2 indicated that by collapsing across the test-events treatments for subjects who did not take notes, a differential relationship between social desirability scores and performance might be obtained for the two rehearsal treatments (n = 30 in each group). The pooled means and standard deviations for the social desirability scores of the two groups (rehearsal treatment $\bar{X}$ = 49.67, S. D. = 5.65; no-rehearsal treatment $\bar{X}$ = 49.83, S. D. = 4.25) were highly similar and not significantly different ($p > .05$). However, social desirability was positively correlated ($r = .50$) with the performance of subjects in the rehearsal group and negatively correlated ($r = -.14$) with the performance of subjects in the no-rehearsal groups. The two correlation coefficients are significantly different vai Fisher's z statistic for the difference between two correlations ($z = 2.52$, $p < .01$). The pooled correlation coefficient representing the relationship between Dogmatism (n = 60) and subjects who had no test events was .19. The difference between these two coefficients was not significant ($p < .10$).

Table 2

Summary Table of Correlation Coefficients between Individual Difference Scores and Number of Ideas Generated for Each Treatment Group (n = 15) in the Experiment

Individual Difference Variables	Listening Only				Note-Taking			
	Rehearsal		No Rehearsal		Rehearsal		No Rehearsal	
	Related Test	Unrelated Test	Related Test	Unrelated Test	Related Test	Unrelated Test	Related Test	Unrelate Test
Debilitating Anxiety	.05	-.25	-.28	.39	.09	-.07	-.24	-.23
Facilitating Anxiety	.43	.29	-.07	-.47**	.06	.29	-.38	.52*
Tolerance of Ambiguity	.51*	.06	-.14	-.47**	-.13	-.08	-.07	.54*
Social Desirability	.45**	.55**	-.04	-.42	-.18	.28	-.30	.14
Dogmatism	-.14	.30	-.23	.10	-.09	.10	-.09	.25
Locus of Control	-.16	-.23	-.18	.31	.06	.27	.00	.26

* $p < .05$

** $p < .10$

Discussion

The results of the present study clearly demonstrate that student activities can be effectively manipulated through strategies that simulate instructor behaviors in naturalistic settings. Those strategies which emphasize note-taking, immediate opportunity for review, and test-events are efficient ones for the recall of main ideas acquired during listening to a presentation. Apparently these effects are not cumulative as implied by the absence of significant interactions. However, we strongly suspect that such interactions might be obtained if the length of the passages was to be increased.

The findings concerning test-events are supportive of those obtained by Rothkopf (1965; Rothkopf & Bisbicos, 1967) who also found questions after learning had a facilitating effect on retention of written material. The activities activated by test-events presumably increase the salience of certain ideas within a passage. If this is a correct assumption, we must also assume that selection of ideas is made from material already stored in memory or that the experimental instructions created expectations which encouraged the subject to employ efficient study methods. Since there has been no feedback or correction on the test event it cannot be assumed that the test functions as another practice trial. Similar explanations were offered by Chapman (1932) and Lawrence and Coles (1954) who noted that post-instructions influenced what is remembered in a perceptual task.

It is possible that the instructions and test events in this study indicated what must be attended to in subsequent passages (that is, expectations or orienting habits were influenced by instructions and participation in the task). However, if this were so we would have found significant effects due to position of the passage. Another experiment is required which

is designed, specifically, to test the relative merits of the post-learning scanning hypothesis and the expectation hypothesis.

Learning increases following a rehearsal period. In itself, this is not a surprising conclusion and supports results obtained in a number of other studies as well as commonsense observation. The typical explanation is that repetition of material learned during listening increases the habit strength of ideas acquired, or some similar notion. However, we also suggest that such a period may provide an opportunity for consolidation. Hebb (1966), for example, notes that the complete effect of whatever takes place during learning comes to fruition only after a period or contemplation, that is, a period during which the learning can "set" or "gel." In this regard, the present authors know of no studies which have directly examined the effects of a consolidation period in learning from connected discourse.

With the exception of studies by Crawford (1925) the few early studies on note-taking provided no convincing evidence that this activity was either beneficial or detrimental to learning while listening. More recently Berliner (1970) found a significant effect of note-taking when measured by one form of a test but not with another. In the present experiment, taking notes clearly led to an increase in the number of ideas recalled. Furthermore it was the only variable which elevated scores on the multiple-choice test. Instead of interfering with learning, as originally hypothesized, note-taking appears to sensitize the learner to certain aspects of the communication. The transformation is one of acting on the incoming information, sifting out relevant material, and organizing important content which is then recorded by the learner. The increased attention given to these concepts while taking notes increases the probability that the concepts will be retrieved even though there is little chance to review the notes immediately after studying.

The significant difference in correlations between social desirability and number of ideas generated under the two rehearsal treatments suggest some interesting possibilities for further studies. The rehearsal period was necessarily a mental rehearsal period (no notes were permitted these subjects) and the experimenter had no means of enforcing rehearsal. Thus, subjects with a greater desire to please and conform socially presumably engaged in rehearsal because it "was the thing to do" thereby resulting in better criterial performance. Subjects who had low social desirability scores were unaffected or less affected by this treatment. This opportunity was lacking in the no-rehearsal group thus resulting in a near zero relationship.

Individual differences in dogmatism also suggested an interaction with the testing treatments. When high dogmatic subjects experienced a related fill-in-the-blank test after listening to a passage, they performed more poorly on "the number of ideas" criterion than high dogmatic subjects who experienced only unrelated tests. High dogmatics who tend to rely on authority (Rokeach, 1960), after having taken a structured and arbitrarily selective test, which implied an authority-standard, may have been left without direction by the completely unstructured, self-dependent free recall test where they were forced to set their own standards. However, in situations where they experienced no previous questions from an authority about the material (i.e., unrelated test events) dependence on an authority's requirements was not made salient.

In summary, we speculate that note-taking and rehearsal function as learning aids which facilitate encoding. Test events increase the salience of certain ideas expressed in a communication and may clarify the instructor's expectations regarding the kind of transformations required. Review provides an opportunity for consolidating the information learned at a given level of

transformation. All strategies provide the student with standards by which he evaluates how his study plan, in the sense of "plan" as defined by Miller, Galanter, and Pribram (1960), is to be implemented and his progress in implementing the plan.

The reflection of student activities as consequences of these instructional strategies are assumed to take the form of such observable outcomes as approach or avoidance of situations, time spent at a task, or, as in the present study, number of words generated. These are general outcomes of activities which mediate other outcomes typically classified as performance changes, and should not be confused with the kind of outcomes typically associated with course objectives. It appears important that the distinctions between outcomes which reflect the attributes of mediating behaviors and outcomes which are the consequences of these behaviors should be maintained in further experimentation if activities, instrumental in learning, are to be understood. That the student does something (such as note-taking, test-taking, and so on) as a consequence of the instructional strategy is clear. Similarly, it is clear that these strategies affect achievement outcomes. The ways in which the student activities actually mediate outcomes is less clear. What needs to be identified are the kinds of activities which affect what have been described elsewhere (Di Vesta, 1970) as Type I (associative), Type II (conceptual), and Type III (inferential) transformations. The identification of activities that make certain stimuli more effective than others seem reasonable objectives for further investigations of listening behavior. Especially important are studies to determine the kinds of activities which produce different goal expectations. Above all the relationships between these and specific instructional objectives need still to be determined.

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Summary

The Effects of Search Strategies on the Learning of Concept-Attitudes[1]

G. Susan Gray and Francis J. Di Vesta

Technical Problem

This study investigated the effects of different organizations of instructional materials on the learning of attitudes. It was assumed that search-instructions would determine the affective direction or polarity of the concept-attitude that was formed; organization by concept-name or by adjectives related to the concept-name would differentially affect the strength of the attitude; and the degree of search required would affect the extent of incidental learning.

General Methodology

An experiment was conducted in which these variables were manipulated with the use of connected-discourse. Instructional material was organized by concept-name and by concept-attributes (adjectives) for two conditions. Each of these conditions was further subdivided into three different focus conditions: that is, to search for a concept represented by adjectives which were positive, neutral, or negative in their connotative meanings. Finally, half of the subjects were to search for concepts for which the specific attributes were provided; the other half searched for concepts in

[1] This is a revision based on a further analysis of data reported for this study in the Semi-Annual Report, January 1970.

which only conceptually related attributes were provided, thereby requiring added search-effort.

Technical Results

The attitude developed toward the focal concept was clearly related to the criterion provided the subject. Organization of material and degree of search required influenced which attitudes were formed and the intensity of the attitudes. Material organized by name resulted in more polarized ratings of the focal tribe than did material organized by attributes. The number of adjectives elicited in each polarization category (positive, neutral, or negative) was directly related to the polarization of the focal tribe. More names were recalled when material was organized by attributes than when organized by names. Less time was spent for identifying the evaluatively positive concepts than for identifying the neutral or negative concepts. In general, more was recalled with positive focus than with neutral or negative focus instructions.

Educational Implications

These results imply that, whether or not he intends to do so, the instructor influences the affective connotations of the concepts he teaches by the adjectives associated with it. We might assume that such influence is more critical when dealing with material from the social sciences than when dealing with material from the physical sciences. Furthermore, these results suggest that material with positive-affective bias is acquired more readily than that with negative-affective bias. When attitudes are to be changed intentionally, it would appear that the material ought to be organized by attributes rather than by names.

Implications for Further Research

The results are sufficiently promising that further extended investigations appear warranted. Of particular importance is the possibility of an interaction with personality variables, especially those which can be hypothesized to increase the sensitivity of the subject to given connotations of words.

The Effects of Search Strategies on the Learning of Concept-Attitudes[1]

G. Susan Gray and Francis J. Di Vesta

The Pennsylvania State University

The efficiency of learning strategies for processing new information is dependent, in part, on characteristics of the situational events. Instructions, as one kind of input event, for example, provides directive cues for the learner which help him to determine the stimuli relevant to the achievement of certain goals as opposed to other goals. Thus, instructions which define goal-related criterial elements also implicitly inform the learner that he must search the textual material for information which satisfies these criteria.

The organization of the textual material itself may also influence the selection of search-strategies and as a consequence, will indirectly influence both incidental and intentional learning. On some occasions the criteria established by the instructions are highly specific (that is, directly related in linear or straightforward associational fashion) and may be matched exactly by words in the text. In such circumstances, the search sequence appears to consist of three phases: discrimination of potential criterial stimuli from the text; comparison of the newly discriminated stimuli with the established criterial elements; and decision to determine whether the goal has been achieved. Such search-behavior appears to be highly selective since the learner tends to disregard those stimuli which are unrelated to the goal. Under these conditions there is high sensitivity to the precise goal-requirements and search takes on direct linear or associational matching. Thus, it is more efficient (as measured by amount

of time spent in search) compared to a searching process which necessitates higher level transformational processes, such as conceptualizing or drawing inferences from textual materials or to one which must satisfy less specific instructional criteria. However, though the search for specific information consumes less time, its apparent efficiency comes at the cost of less incidental learning. In other words, the learner retains the criterial information and little else. As Frase (1969a) has shown, little learning incidental to criterial requirements occurs when the criteria are highly specific.

When instructions provide less specific criteria, such as those which are only conceptually related to the text or those criteria which require inferential activity, the learner's task becomes a more difficult one. Stimuli cannot be eliminated on the basis of straightforward linear perceptual dissimilarity. Another process, that of translation, must intervene between the discrimination of potential stimuli and the matching of these stimuli to the goal criteria. Since the learner's task has become more complex, his search activities should increase, resulting in increased contact with more of the material, thereby increasing the opportunity for incidental learning. Frase and Silberger (1968), for example, found a .63 correlation between time spent in search and recognition scores. In another report, Frase (1969b) has shown that when more complex inferences are required, the learner retains more information than when the task demands are simpler.

The present study was conducted to extend the above rationale to investigations of the effects of instructions and organization of textual materials on the formation of concept-attitudes (see, for example, Rhine, Cole, and Ogilvie, 1968). It extends the Frase study, in which the learner

was instructed to find specific bits of information, by examining the effects of similar instructions on the acquisition of attitudes toward potential attitude-objects provided in the text. A basic assumption was that instructions to search for concepts characterized by negative or positive traits would determine the polarity of the dominant concept-attitude. Instructions to identify a name (concept) described by traits only conceptually related to the criterial set of traits, as opposed to traits identical to the criterial set, were expected to result in increased incidental learning. Since the former situation requires transformation (encoding and decoding) processes, vigilance or attention would be increased with a consequent increase in incidental learning. Instructions to search for a concept that was normatively evaluated as positive (or negative) in nature, were expected to influence the recall of congruent information, even though incidental to learning the criterion information, and less information representing the opposite attitude. This assumption is based on the reasoning that searching for one kind of information will lead to greater attention to similar kinds of information if discriminations are to be made while the readily apparent characteristics of opposite stimuli will lead to their immediate rejection.

The organization of textual material was a second variable considered as a source of influence in learning a concept-attitude. Frase (1969a) found that the way in which the text material was organized determined the specific information that was remembered. When the material consisted of verbal concepts (names) and their attributes, more attributes than names were remembered when the material was organized by names. However, more names than attributes were remembered when the material was organized by attributes. It was hypothesized that the same effects of organization would be obtained in the present experiment.

Methods

Subjects

The subjects were 30 undergraduate students (13 males and 17 females) enrolled in an introductory educational psychology course. They were randomly assigned to the six treatments of the experiment with the restriction that an equal number of subjects was assigned to each condition. The subjects received course credit for participating in the experiment. The numbers of subjects employed in this experiment correspond to those used in earlier experiments (see, for example, Frase, 1969).

Materials

The textual material consisted of short passages in which 12 fictitious tribes of people were described. They were labeled by 12 "nonsense" words of five letters in each name, and were described by a total of 9 adjectives from each of the three semantic dimensions of Evaluation, Activity, and Potency (27 adjectives in all) based on ratings summarized in the Atlas of Semantic Profiles for 360 Words (Jenkins, Russell, and Suci, 1958). Each set of 9 adjectives was comprised of three with positive polarity (below 3.0 on a seven-point scale), three with neutral polarity (between 3.5 and 4.5 on a seven-point scale), and three with negative polarity (above 5.0 on a seven-point scale) on its respective dimension of the semantic differential scale.

Each tribe was described by three adjectives, one adjective from each of the three dimensions. Only one of the 12 tribes was described with 3 positively rated adjectives (i.e., beautiful, swift, and rugged), only one with 3 neutrally rated adjectives and only one with 3 negatively rated adjectives (i.e., ugly, weak, and slow). All other tribes were described by varying combinations of positive, neutral, and negative adjectives.

Experimental Treatments

The material was organized either by the names of the tribe or by the adjective dimension. In the name-organized condition, the name of each tribe was presented with its three descriptive adjectives as shown in the following example:

The people of the Carom tribe are plain.

The Caroms are a swift tribe.

The Carom people are rugged.

In the adjective-organized condition, all adjectives from one dimension were presented together with their associated tribes as follows:

The people of the Balap tribe are beautiful.

The people of the Carom tribe are plain.

The people of the Zumap tribe are ugly.

Each of the name- and adjective-organized presentations was orthogonally crossed with three different focus conditions; that is, the subject was instructed to find a tribe described by adjectives which were all positive, all neutral, or all negative. The overall design implied a 2 x 3 factorial analysis of variance for analyzing the data.

Procedure

The material for each of the six conditions was presented in booklet form. The first page contained the instructions, the next three pages the material to be learned. The instructions were the same for all six conditions with only the name of the focus tribe and type of focus (positive, neutral, or negative) changing for the 3 different focus conditions.

The task was administered in an individual testing session in which the subject was instructed that he was to participate in a verbal learning experiment designed to investigate the different ways people go about learning

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The material for each of the six conditions was presented in booklet form. The first page contained the instructions, the next three pages the material to be learned. The instructions were the same for all six conditions with only the name of the focus tribe and type of focus (positive, neutral, or negative) changing for the 3 different focus conditions.

The task was administered in an individual testing session in which the subject was instructed that he was to participate in a verbal learning experiment designed to investigate the different ways people go about learning

new materials and that the booklet was a report on 12 newly discovered peoples. In the positive focus condition, the subject was instructed to find the most attractive, most active, and the most powerful tribe as fast and as accurately as possible. In the neutral focus condition, the subject was to look for the tribe which was the most neutral in attractiveness, activity and power. In the negative focus condition, the subject was to identify the name of the tribe that was least attractice, least active and least powerful. The experimenter stressed that only one of the tribes met the three qualifications.

After initiating his study, the total search time taken by the subject was measured up to the point when the booklet was turned face down, at which time the subject gave the name of the tribe he believed fulfilled the criterial qualifications. If the answer was correct, the experimenter then obtained a rating of how certain the subject was that he was correct. If the subject was incorrect, he was instructed to reexamine the materials until he found the correct tribe. The time required was added to his initial search period.

In the second phase of the experiment, the subject was examined on the material. The test consisted of a recognition task in which the subject circled, from a list of names, the names of the tribes that were mentioned in the article. Then he was asked to recall on paper the three adjectives associated with each of the twelve tribes. Finally, the subject rated each of the twelve tribes on eight scales (likeable-unlikeable, active-passive, attractive-unattractive, friendly-unfriendly, dynamic-static, excitable-calm, important-unimportant, and successful-unsuccessful). Each scale was divided into seven equal parts and bounded by the two polar adjectives of a dimension. The subject was told to place on the line representing each scale, a check

mark which reflected his opinion of the tribe in question. For purposes of scoring the left-hand members of the adjective pairs presented above were assigned a value of 7 and the right-hand member a value of 1, with values of 6-2 assigned to the divisions of the scale in between the poles. Total score ratings for each tribe were obtained by adding the scores of the eight scales together. Consequently, a score of 32 would reflect a neutral rating, a score of 8 the most negative rating possible, and, finally, a score of 96 would be the highest possible positive rating. The three parts of the test were administered separately. Once the subject had completed one part he was not permitted to return to it.

Results

The ratings of the focus tribes by subjects in all conditions were analyzed via a 2 x 3 factorial analysis of variance with 3 repeated measures. There were two kinds of organization (adjective vs. tribe), three levels of focal instructions (positive, neutral or negative). This analysis yielded F (2,24) = 11.34, $p < .01$ for the effect due to focus instructions; F (4,48) = 5.63, $p < .01$ for the effect due to the interaction between the focus tribe and rating of the focus tribe. None of the other main effects or interactions were significant ($p > .05$).

The mean ratings are presented in Table 1. There it may be seen that the subjects in the positive focus conditions rated the focal tribe much higher than did the subjects who rated the same tribe in either the neutral or negative conditions. Similarly, the subjects in the negative condition, rated the negative tribe much lower than did subjects in either of the other two conditions. It should also be noted that when the material was organized by adjectives there was a tendency for the focal tribe of the

Table 1

Mean Ratings of Focus Tribes, Response Latencies and Certainty Ratings For all Experimental Conditions

Polarity and Kind of Organization	Treatment			Response Latency	Certainty Ratings
	Positive Focus	Neutral Focus	Negative Focus		
Positive					
Adjective	52.0	26.0	35.4	113.2	9.0
Name	47.2	34.4	27.2	97.2	8.4
Total	49.6	30.2	31.3	105.2	
Neutral					
Adjective	37.0	32.6	30.8	166.2	7.0
Name	31.8	31.4	31.2	103.6	9.0
Total	34.4	32.0	31.0	134.9	
Negative					
Adjective	36.6	30.4	15.6	170.6	9.6
Name	36.0	31.6	22.4	159.8	8.2
Total	36.3	31.0	19.0	165.2	

Note.--Response latencies are in seconds.

corresponding focus condition to be given a more polarized rating. In the positive focus condition, the positive focal tribe was rated as more positive ($\bar{X}$ = 52.0) in the treatment where materials were organized by adjectives than in the treatment where materials were organized by names ($\bar{X}$ = 47.2). While the difference in mean ratings of the neutral tribe in the neutral focus condition was not significant (adjective-organization, $\bar{X}$ = 32.6; name-organization, $\bar{X}$ = 31.4), there was a discrepancy in the negative focus treatment in mean ratings of the negative focal tribe. In this treatment, where the material was organized by adjectives, the mean ra rating was more polarized in the negative direction ($\bar{X}$ = 15.6) than was the mean rating of the negative tribe when the material was organized by name ($\bar{X}$ = 22.4).

The direction of focus influenced the polarity of adjectives (positive, neutral, or negative) elicited in the free recall task. An analysis of these data, yielded F (2,48) = 4.71, $p < .05$ for the effect due to kind of adjectives elicited; F (2,48) = 4.90, $p < .05$ for the effect due to the interaction between the way the material was organized and the kind of adjective elicited; and F (4,48) = 7.74, $p < .01$ for the effect due to the interaction between the focus tribe and the kind (polarity) of adjective elicited. None of the other main effects or interactions were significant. Nor were there significant differences in the number of adjectives elicited in the three semantic dimensions of evaluation, potency, and activity.

The means for the kinds of adjectives elicited are summarized in Table 2. Again it can be seen that the number of adjectives elicited in any one treatment was greatest for the polarity that corresponded to the polarity

Table 2

Mean Number of Adjectives and Names Elicited in all Treatments

Polarity and Kind of Organization	Treatment			Total	Number of Names Given
	Positive Focus	Neutral Focus	Negative Focus		
Positive					
Adjective	44.0	9.0	27.0	80.0	8.6
Name	31.0	11.0	10.0	52.0	6.8
Total	75.0	20.0	37.0	132.0	7.7
Neutral					
Adjective	31.0	20.0	15.0	66.0	8.4
Name	11.0	23.0	12.0	46.0	5.2
Total	42.0	43.0	27.0	112.0	6.8
Negative					
Adjective	9.0	1.0	32.0	42.0	8.2
Name	28.0	32.0	35.0	95.0	5.4
Total	37.0	33.0	67.0	137.0	6.8

represented in the focal tribe. Thus, the subjects in the positive condition elicited more positive adjectives, that is evaluated the tribe more favorably, than did subjects rating the same tribe in either the neutral or negative conditions. Similarly, the subjects in the neutral condition elicited more neutral adjectives than did those subjects in either the positive or negative condition; while the subjects in the neutral condition elicited more negative adjectives than did those in either of the other two other conditions.

The analysis of number of names elicited yielded only one significant effect. The F (1,24) = 10.49, $p < .01$, obtained for the effect due to the way the material was organized, indicates that when the material was organized by attributes more names were recalled than when the material was organized by names. This effect was a replication of one obtained by Frase (1969a). However, the opposite effect obtained by him, namely that the condition in which the material was organized by attributes would lead to the elicitation of fewer adjectives, was not supported in the present study.

The analysis of the certainty ratings yielded an F (2,24) = 3.44, $p < .05$ for the effect due to the interaction between organization of material and focus conditions. The main effects due to either of these variables, were not significant, however. The mean certainty ratings are summarized in Table 2. In the positive and negative focus conditions, subjects rated themselves as being more certain they had found the correct tribe when the material was organized by adjectives. However, the subjects in the neutral-focus condition indicated greater certainty when the material was organized by name.

Although there was a tendency for latency to increase from the positive to negative condition, these differences were not statistically significant.

Discussion

The results clearly indicate that organization of textual material and search-requirements influence the formation of concept-attitudes. The focal tribe of each condition was clearly rated in the direction implied by the instructions. However, ratings of the other tribes in the passage did not seem to be affected by the direction of search associated with the focal tribe, thereby implying that little incidental learning took place. Accordingly, subjects appeared to have rated all tribes that could not be recalled in a neutral manner. In fact, some subjects indicated in a post-experimental interview, that they marked the middle of each adjective scale for all tribes about which they could remember nothing.

Perhaps one of the more interesting findings of this study was the influence of the way the material was organized on the polarization of the rating. When the material was organized by adjectives, subjects rated the positive focus tribe as more positive in the positive focus condition than did subjects searching through material organized by name. The same was true in the negative focus condition where the focus tribe was rated more negatively by subjects in the adjective-organized condition than did their counterparts in the name-organized condition. An explanation tendered for this increased polarization of ratings in the adjective-organized condition is the consequence of a longer time spent in comparing tribes with attributes corresponding to the polarity of the focus criterion. Thus, frequency (i.e., exposure) was increased with a corresponding increase in the evaluative polarity in the rating of the attitude-object (see Zajonc, 1968). When the material was organized by name, any tribe characterized by an adjective which did not meet the criterion could be immediately eliminated without bothering to look at all of its characteristics.

The effects of focus and organization of material on amount of material remembered provided some support for the remaining hypotheses of this experiment. Subjects who read adjective-organized material recalled more names of tribes. This result confirms Frase's (1969a) conclusion that material organized by adjectives facilitates the learning of names. However, the inverse relationship, that more adjectives would be remembered when the material was organized by names was only partially supported since it was true only for the negative focus condition. The failure to find more adjectives remembered when material was organized by name is explained by the search processes necessitated by the instructional criteria. Before any subject could identify the concept-name characterized by the criterial requirements he had to review all nine possible attributes to decide which of these satisfied the instructional focus polarity. Having found the correct three attributes, only then could he search for the name associated with all three. Hence, all subjects, regardless of textual organization condition, necessarily had to encode all adjectives and locate them in semantic space on the dimensions of attractiveness, activity and power. We reasoned that these transformational processes would eliminate the superiority of the name-organized condition in recalling adjectives as reported by Frase (1969a).

The totals of types of adjectives generated (Table 2) for all three conditions implies that polarity of concept-attitude (positive, neutral or negative) of the focus instructions affects the kind of adjectives recalled. Thus, when subjects focussed on positive attributes they elicited more positive traits than any of the others; when they focussed on negative attributes they elicited more negative attributes than either neutral or positive. Again, this result appears to be a matter of the orienting

influence of the focal items. Once the general characteristics of the attributes have been identified, precise discrimination requires the subject to attend more to the items which are similarly polarized; those with opposite values can be readily eliminated as incorrect.

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Summary

The Effects of Passage Organization and Note-taking on the Selection of Clustering Strategies and on Recall of Textual Materials

Charles B. Schultz and Francis J. Di Vesta

Technical Problem

Written materials can be organized into paragraphs in which the common element is a concept name (e.g., the name of a nation), a concept attribute (e.g., the geographic features of several nations), or in which the paragraphs have little or no common elements. The purpose of the present experiment was to examine the effect of each type of passage organization on recall and on the subject's selection of a clustering strategy (i.e., the selection of a concept name or concept attribute clustering strategy). It was expected that the more organized passages would produce greater recall and that the subject's selection of clustering strategies would reflect the organizational pattern of the passage. By making subjects more dependent upon the passage organization (i.e., by prohibiting note-taking during the study period), a less preferred clustering strategy was expected to be gradually adopted when it was compatible with the passage organization.

General Methodology

In a laboratory experiment, subjects were provided three opportunities to study a passage comprised of six paragraphs which described imaginary nations. In one condition each paragraph described different characteristics of the same nation. In another condition, each paragraph described

the same type of characteristic for all of the nations. The sentences in a third passage were randomly ordered. Each subject was given one type of passage to study. Half of the subjects in the three passage organization groups were permitted to take notes while the remainder were instructed to study by reading the passage. After each study period the subjects wrote down the statements they could remember. This procedure resulted in three trials on which measures of recall and clustering were obtained.

Technical Results

Passages organized by concept name or by concept attribute produced more recall than the randomly ordered passage. Passage organization also influenced the selection of clustering strategies, particularly when note-taking was not permitted. Concept name was the dominant clustering strategy. It was immediately adopted by subjects studying the concept name passage. In contrast, the concept attribute strategy was adopted only after several experiences with the concept attribute passage. There was a tendency for the concept attribute group who took no notes to recall less and to commit more errors than the concept name group during the early learning trials. A moderate but reliable correlation was obtained between clustering and recall.

Educational Implications

Although a large proportion of the learner's efforts are devoted to the study of written materials, there has been little systematic investigation of the effect of the organization of written materials on learning and retention. The results of the present study suggest that organization is an important variable influencing the recall of written material and

that the organizational pattern of instructional materials should be made salient to the learner. Instructional topics which vary greatly or "wander" can be expected to be poorly learned. In addition, when the organization of written materials differs from the organizational pattern to which the learner is accustomed, learning and recall will be facilitated if the instructor helps the learner adjust to the new pattern. This may be accomplished by providing several exposures to the new pattern before the instructional topic is presented, by providing the learner with an outline of the different organization, or by encouraging him to take notes.

Implications for Further Research

In the present experiment, when subjects studied passages whose organization differed from their dominant or preferred clustering strategy, early efforts to recall the passage were not as affective as when the passage organization was consistent with their preferred strategy. This "interference" effect suggests direct manipulation of the congruence between the clustering strategies the subject uses and the organizational pattern of the passage he studies.

Although a reliable correlation was obtained between clustering and recall, the substantial relationship one might expect from free recall studies using word lists did not occur. The identification of the conditions under which a stronger correlation between clustering and recall can be obtained or the identification of other factors which are related and contribute to recall are important research topics which merit investigation.

The Effects of Passage Organization and Note-taking on the Selection of Clustering Strategies and on Recall of Textual Materials

Charles B. Schultz and Francis J. Di Vesta[1]

When given the task of learning randomly ordered lists of words, Ss tend to adopt a clustering strategy during learning and recall in which the words are subjectively organized into experimentally defined categories (Bousfield, 1953) if they are highly dominant or idiosyncratic categories (Seibel, 1964) if they are not. The importance of this finding is that subjective organization facilitates memory of learned materials.

Frase (1969) extended the investigation of organizational strategies in free recall to passages comprised of simple sentences. Each sentence in the passage expressed an association between a concept name (CN) and a value of the concept attribute (CA). The following sentence is an illustration drawn from one of Frase's experimental passages in playing chess: "The pawn (CN) moves in a forward direction (CA)." As in the subjective organization of a single list of words, typically used in the free recall paradigm, the learner of connected discourse has the option of using different clustering strategies. Accordingly, he can group by name, i.e., he can group statements about all the attributes of the same concept together or, he can group by attribute, i.e., he can group all statements about the same attribute for each of the concept names. Moreover, a given passage can be experimentally arranged in at least three ways: sentences can be grouped by name (CN), sentences can be grouped by attribute (CA), or they can be sequenced in a random order (R).

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[1] The authors acknowledge the cooperation extended by the students and staff of the Lewistown-Granville Campus of the Penn Highlands High School, Pennsylvania. In particular, the assistance of Kenneth H. Hidlay, Principal, and of Henrietta Houser and Althadell C. Riden, Guidance Counselors, was gratefully appreciated. We also acknowledge the efforts of Timothy Dangel, of The Pennsylvania State University, who assisted in the collection of the data.

The contiguity of items belonging to the same category appears to affect both recall and clustering. When the presentation of a word list was blocked, so that all the words in the same category appeared consecutively, clustering in free recall was more frequent than when the words were mixed (Cofer, Bruce, and Reicher, 1966). Moreover, recall of the blocked list was more efficient than that of the mixed list when presentation was rapid (i.e., at one-second intervals). In regard to connected discourse, Frase (1969) found that recall of statements in passages blocked or organized by either name or attribute was superior to recall of a randomly ordered passage. However, the two organized passages were not equally effective in their influence on the amount of clustering or the S's choice of a clustering strategy; the passage organized by names resulted in more clustering than did the one organized by attribute. The tendency to employ the name clustering strategy appeared dominant, since Ss who read the attribute and random passages clustered more by name than the passage they read.

The present experiment extended the generalizability of earlier studies (Cofer, Bruce, and Reicher, 1966; Frase, 1969) by examining clustering and recall in a passage that is more closely analogous to materials used in instructional settings. Accordingly, typical social science content was selected as the topic of the passage. In addition, the sentences contained modifiers and parenthetical phrases and the order of the CN and CA elements within the sentence was varied. It was expected that these changes would not alter the organizational effects of the passage on recall and clustering.

A primary purpose of this experiment was to investigate the conditions under which the S's clustering deviates from the passage organization. In Frase's experiment the Ss were given the opportunity to take notes while they

studied the passage. However, we reasoned that note-taking during the study period may have the effect of influencing the learner to change his clustering strategy from the organization implicit in the passage to one of his own choosing. Thus, there would be more variation in clustering strategies among Ss who take notes than among those who learn without notes, since notes may provide a means of "external storage" and a device to rearrange in stereotypic fashion the organizational pattern of the passage. Without a device for external storage and its potentiality for normative or even idiosyncratic transformation, the learner must rely more heavily upon the original organizational pattern in the passage.

It was also reasoned that when the learner relies on a passage organization consistent with his dominant clustering strategy (e.g., organization by name) during learning he would employ that organizational mode during recall with the effect of facilitating what is remembered. However, when S is forced to rely on a form of passage organization during learning which is inconsistent with his dominant strategy, (e.g., attribute organization), as he must when he does not take notes, then he must relinquish the strategy he normally employs and adopt a different, less preferred technique. As a consequence of employing a subordinate and less-practiced strategy, recall would suffer.

The aforegoing rationale suggests the following hypotheses: (a) The effect of passage organization on the learner's clustering in recall is greater without notes than it is with notes. (b) When the learner must depend upon the passage organization, the adoption of the strategy to organize the material by concept-name is relatively spontaneous while adoption of the strategy to organize by attribute is gradual. (c) Acquisition

The contiguity of items belonging to the same category appears to affect both recall and clustering. When the presentation of a word list was blocked, so that all the words in the same category appeared consecutively, clustering in free recall was more frequent than when the words were mixed (Cofer, Bruce, and Reicher, 1966). Moreover, recall of the blocked list was more efficient than that of the mixed list when presentation was rapid (i.e., at one-second intervals). In regard to connected discourse, Frase (1969) found that recall of statements in passages blocked or organized by either name or attribute was superior to recall of a randomly ordered passage. However, the two organized passages were not equally effective in their influence on the amount of clustering or the S's choice of a clustering strategy; the passage organized by names resulted in more clustering than did the one organized by attribute. The tendency to employ the name clustering strategy appeared dominant, since Ss who read the attribute and random passages clustered more by name than the passage they read.

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during the early stages of learning a passage organized by attribute is impaired relative to acquisition during the early stages of learning a passage organized by name.

Method

Design

High school juniors and seniors were given three brief study periods to learn a passage which described six imaginary nations. The study periods were each followed by a writing period during which a free recall test was administered. Measures of both recall and clustering of responses were obtained from the free recall test. Three levels of passage organization (concept name, concept attribute, and random sentence sequence) were orthogonally crossed with two note-taking conditions (Note-taking and Reading-only). These manipulations imply a 2 x 3 x 3 factorial analysis of variance with repeated measures (trials) on the last factor.

Subjects

The Ss were eleventh and twelfth grade students from a local high school, who were in the upper 20% of their class in academic rank. They were randomly assigned to six experimental conditions. None had participated previously in any experiment.

Stimulus Materials

The basic experimental passage was constructed according to procedures described by Frase (1969). The passage consisted of statements about six imaginary nations such as Brontus, Bismania, and Nurovia. Six characteristics were described for each nation (e.g., its geographic features, socio-economic stage of development, and type of government) resulting in a matrix of six nations (concept names) by six characteristics (concept

attributes) as summarized in Table 1. Statements were constructed for each cell in the 6 x 6 matrix. For example, the following sentences were based on the row of attributes describing geographic features:

Bismania is marked by an extensive system of lakes.

Most of Brontus is plain, level land.

Much of the southern part of Nurovia is desert land.

Atweena is an island nation.

Galbion is a land-locked nation.

A mountainous terrain characterizes much of Egrama.

Three different sets of materials were developed: One was based on the organization of statements according to concept name, i.e., the statements were derived from the contents of the columns of the matrix (CN). A second was organized by concept attribute, i.e., the statements were derived from the contents of the rows of the matrix (CA). A third consisted of arranging the sentences in a random order (R). The amount of CN and CA clustering built into the three experimental passages was determined by the same procedure used to compute clustering ratios. (See the section on Scoring below.) The percentage of organization by name for Passage CN = 100%, for Passage CA = 0%, and for Passage R = 7%. The percentage of organization by attribute for Passage CN = 0%, for Passage CA = 100%, and for Passage R = 17%.

Procedure

Upon entering the experimental room, two Ss were seated at separate desks. The Ss were told that they were about to participate in a learning experiment in which they were to study a passage containing descriptions

Table 1

The Concept Attribute by Concept Name Matrix Employed in the Construction of the Passage

Concept Attribute	Concept Name					
	Bismania	Brontus	Nurovia	Atweena	Galbion	Egrama
Type of society	modernized, well-developed	urban	urban	urban and manufacturing	urban and industrial	industrial
Socio-economic conditions	national unity	social unrest	full employment	peace and prosperity	economic depression	political factions
Geography	lakes	level, plain land	desert	island	land-locked	mountainous
Government	one-party	democracy	autocratic	representative republic	totalitarian	coalition
Population growth	increasing	decrease	increase	increase	decrease	decreasing
Death rate	13 per 1000	15 per 1000	10 per 1000	12 per 1000	14 per 1000	11 per 1000

of a number of imaginary nations. Their task was to remember as many of the statements from the passage as possible. They were further told that they would be given three five-minute study periods each of which would be followed by a six-minute writing period.

Organization treatments. One experimental dimension consisted of three levels of passage organization as described under Materials. Any one S was administered only one passage, either CN, CA, or R.

Note-taking treatments. The passage organization conditions were orthogonally crossed with two note-taking treatments. Half of the Ss assigned to study each of the passages in the three organizational treatments were given instructions to the effect that they could take notes (i.e., the Note-taking treatment) to help them remember the passage during the study period. They were told the notes would not be available to them during the writing period. The remaining Ss (i.e., those in the Reading-only treatment) were not offered an opportunity to take notes. No mention of notes was made in the instructions to these groups, nor were they provided with paper on which notes might have been recorded.

Scoring. The free recall protocols were scored for the number of statements correctly recalled, the number of errors, and clustering ratios for both CN and CA. In order to be counted as a correct statement, the CN (or an approximation of the correct name) must have been associated with the correct value of a CA. A further constraint in procedure applied to the scoring of compound attribute statements such as, "Bismania enjoys peace and prosperity." In this case, either peace or prosperity was required if the statement was to be scored as correct. In the case of a single attribute statement such as, "Brontus is an urban society," the answer may have included an incorrect attribute value as long as the correct attribute

value was also included. Thus, the answer, "Brontus is an industrial and urban society," was scored as correct. Clustering ratios were computed according to the formula employed by Frase (1969):

$$\frac{\text{Number of Repetitions}}{(\text{Total Number of Sentences Recalled})-(\text{Number of Categories Recalled})}$$

Both correct, incorrect, and incomplete responses were included in the clustering ratios.

Results

Measures of clustering, statements correctly recalled, and errors were obtained for each of the three free recall trials. Scores obtained from these measures were analyzed via a 2 x 2 x 3 analysis of variance with repeated measures (trials) on the last factor. The results of these analyses are presented separately below.

Clustering

Separate analyses of variance were made of the amount of clustering during recall based on names and on attributes. The analyses based on the CN ratio yielded F (2,42) = 3.59, $p < .05$ for the effect due to passage organization. Mean clustering scores for Groups CN, CA, and R were $\bar{X} = 71.44$, $\bar{X} = 42.71$, and $\bar{X} = 53.27$ respectively. Newman-Keuls multiple comparison procedures were used to test differences among the means obtained from this analysis as well as from others to be described below. According to this test, the CN clustering ratio for Group CN was greater than that for Group CA ($p < .05$). A similar analysis of variance of the CA clustering ratio yielded F (2,42) = 5.54, $p < .01$ for the effect due to passage organization. The mean CA scores for the three passage organizations were $\bar{X} = 20.00$ for Group CN, $\bar{X} = 53.31$ for Group CA, and $\bar{X} = 29.62$ for Group R. CA clustering by Group CA was greater than that of both Groups CN ($p < .01$) and R ($p < .05$).

The direction of the means in both analyses implied a negative relationship between CA and CN clustering. When an individual adopts and uses one strategy, his clustering ratio on the other strategy is minimal. The overall correlation between the use of CN and CR strategies was r (47) = -.84, p < .01. Correlations within each (df = 15) of the three passage organizations were r = -.95 for the CA group, r = -.91 for the CN group, and r = -.32 for the R group. The relatively low negative correlation obtained for Ss in Group R as well as their low clustering scores on both CA and CN measures suggest that recall was not as systematically organized as either of the other groups, thereby reflecting the lack of organization in the passage.

Although each of the textual organizations appears to have influenced the selection of one or another strategy, the CN and CA strategies were not used to the same extent. In order to determine the dominance of one strategy, a t test of the difference between correlated means of CN and CA scores was made (McNemar, 1969, p. 113-114). This analysis yielded, t (47) = 3.01, p < .01, implying that CN strategies were preferred to CA strategies.

The impact of the CN and CA passage organization on the clustering strategies of Ss who took notes and on those who did not was examined in a separate analysis. The means for these groups are summarized in Table 2. Note-taking while studying appears to minimize the influence of passage organization on strategy selection. Both the use of CN clustering by Group CN and of CA clustering by Group CA are influenced more by passage organization when students must rely mainly on memory than when notes were permitted. A

Table 2

Mean Concept Attribute (CA) and Concept Name (CN) Scores for Each of the Note-taking and Passage Organization Conditions over Trials

Note-taking Treatment	Passage Organization	Trials 1	Trials 2	Trials 3	Total
		Concept Attribute Scores			
Note-taking	R	26.62	19.50	19.00	21.71
	CN	31.88	29.25	27.88	29.67
	CA	42.12	41.25	50.38	44.58
Reading-only	R	38.00	38.00	36.62	37.54
	CN	6.25	12.88	11.88	10.33
	CA	59.00	52.12	75.00	62.04
		Concept Name Scores			
Note-taking	R	74.62	45.75	60.12	60.17
	CN	45.88	68.00	53.38	55.75
	CA	51.12	50.50	42.00	47.88
Reading-only	R	60.38	41.12	37.62	46.38
	CN	91.38	83.75	86.25	87.12
	CA	41.38	48.38	22.88	37.54

comparison of the mean CN scores for Group CN Ss who took notes ($\bar{X}$ = 55.75) and those who did not take notes ($\bar{X}$ = 87.12) yielded t (42) = 2.04, $p < .05$. A similar comparison of the CA clustering scores for Group CA Ss who took notes ($\bar{X}$ = 44.58) and who did not ($\bar{X}$ = 62.04) was in the expected direction: however, the difference in this case was not reliable (t [42] = 1.20, $p > .05$).

It was expected that the CN strategy would be immediately adopted by Ss who studied the CN passage, particularly when they were not permitted to take notes. Adoption of the CA strategy by Ss studying that passage was expected to be gradual. In order to determine whether the effect of the Passage-organization x Trials interaction implied by this hypothesis was obtained, a clustering score was required which would reflect both CN and CA clustering factors. Accordingly, a Combined Clustering Score (CCS) was computed for each S as follows: CN ratio score - CA ratio score + 100. This procedure resulted in a range of scores from zero to 200. The upper limits of the range indicate complete CN clustering; the lower extremes suggest complete CA clustering. Scores approximating the mid-point of the range imply that neither strategy was consistently adopted.

The combined clustering scores (CCS's) across trials for Ss in Group CA and Group CN are displayed in Figure 1. In the Reading-only condition, Ss reading the CN passages achieved high CCSs in the early trials. On the other hand, no strategy preference was reflected in the CCSs for Ss reading the CA passages during the first two trials; the CA strategy was not adopted until the third trial. A test of the interaction implied by these means was made by comparing CCS's for the CN and CA group for the second and third

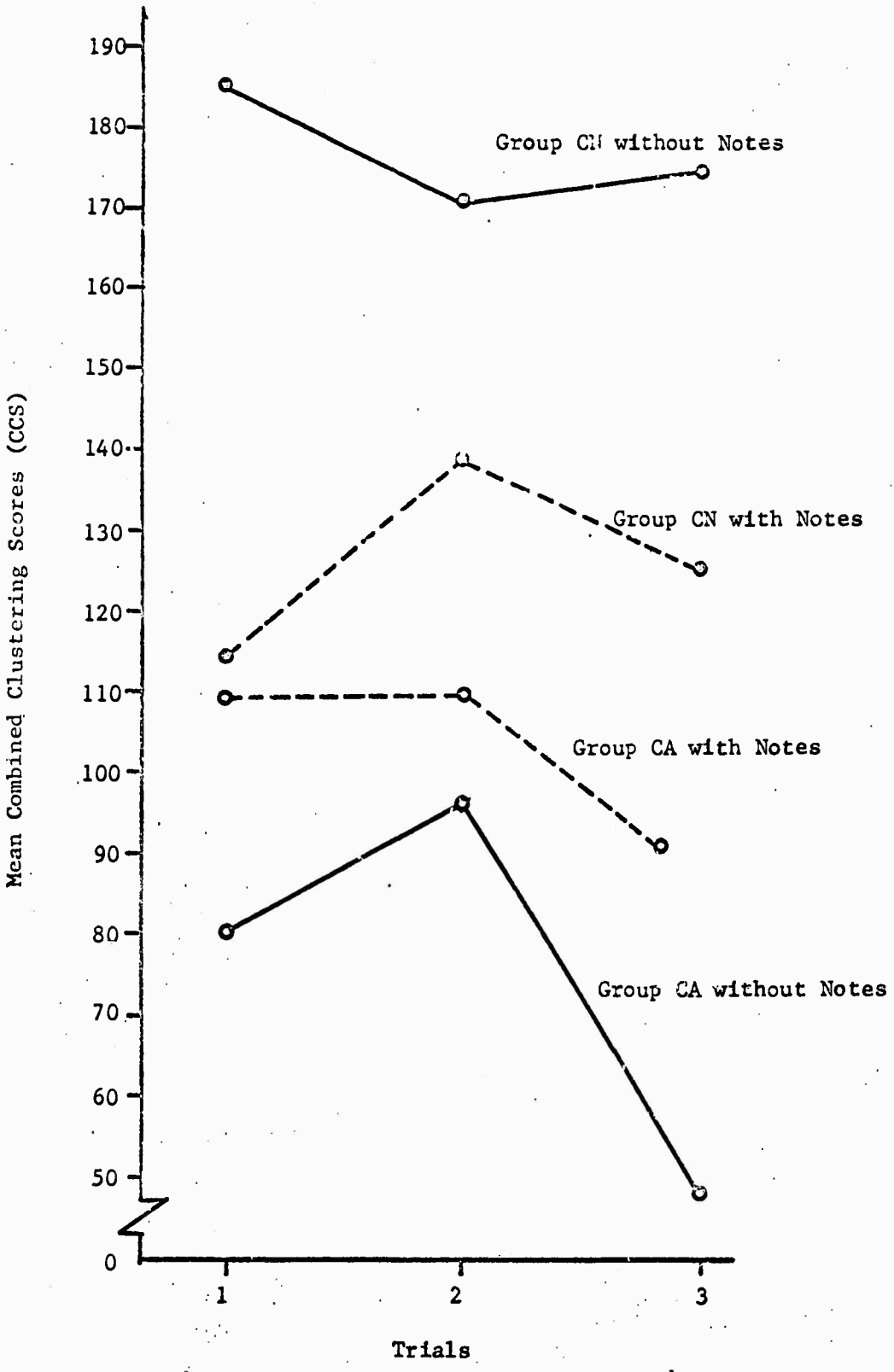

Figure 1. Combined clustering scores for passages organized by name (CN) and by attribute (CA) in the Note-taking and Reading-only conditions depicting the Passage-Organization by Trials interaction.

trials as follows: $\frac{\hat{\psi}}{\sqrt{MS_{error(w)} \Sigma \left(\frac{w^2}{n}\right)}}$ (Games, 1971). This analysis yielded t (84) = 2.02, $p < .05$. Because of the sharp drop in CCS's for Group CA between trial two and three, a further analysis was conducted by comparing the mean CA clustering scores across trials for Group CA without notes. The difference in clustering between Trial 1 ($\bar{X}$ = 59.00) and Trial 2 ($\bar{X}$ = 52.12) was not significant ($p > .05$). However, the analysis of the difference between Trial 2 and Trial 3 ($\bar{X}$ = 75.00) yielded t (84) = 1.93, $p = .05$ (for a two-tailed test with df = 80, t .05 = 1.99). The difference between the means suggests an early adaptation phase where relatively little consistent clustering occurs, followed by a relatively complete adoption of the CA strategy.

Recall

An analysis of the effect of passage organization on recall of correct statements yielded F (2,42) = 6.86, $p < .005$. The mean number of statements recalled for the three groups were as follows: $\bar{X}$ = 10.92 for the Group CN, $\bar{X}$ = 10.73 for the Group CA, and $\bar{X}$ = 6.98 for Group R. Comparisons among these means indicated recall was significantly greater in Groups CN and CA than it was in Group R ($p < .01$), but Groups CN and CA did not differ significantly from each other ($p > .05$). Although there were no significant effects due to note-taking ($F < 1.00$), the analysis yielded F (2,84) = 74.08, $p < .001$ for the effect due to Trials.

The Ss who studied the CA passage had to either reorganize the passage to a CN pattern or to relinquish their presumably favored CN clustering strategy and adopt one consistent with the CA organization externally imposed on the passage. When the change in clustering strategy was not facilitated by an "external device" such as notes, it was expected that shifting strategies

would interfere with early attempts to recall the contents of the passage. The learning curves for Groups CN and CA are summarized in Table 3. On the first trial of the Reading-only condition, recall by Group CA was depressed relative to recall by Group CN. In contrast, learning curves for Groups CN and CA in the Note-taking condition were parallel. However, the Passage-organization x Trials interaction for correct statements recalled by the Reading-only group was not significant ($p > .10$).

The number of statements recalled correctly was not related to either clustering via CN strategy ($r = -.03$) or the CA strategy ($r = -.04$). A score comprised of the largest clustering ratio for each trial was moderately but reliably related to recall ($r\,[47] = .33$, $p < .05$).

Errors

Analyses were made of the incorrect statements included in free recall. This analysis yielded $F\,(2,42) = 1.74$, $p < .10$ for the effect due to Passage-organization and $F\,(2,42) = 4.13$, $p < .025$ for the effect due to Note-taking. The latter effect implies that more errors were made with notes ($\overline{X} = 3.06$) than without notes ($\overline{X} = 1.96$).

The effect due to the interaction of Passage-organization x Trials yielded $F\,(2,84) = 3.84$, $p < .01$. This interaction was marked by the general tendency of errors to increase across trials for Group R ($\overline{X} = 2.69$ for Trial 1, $\overline{X} = 2.88$ for Trial 2, $\overline{X} = 3.56$ for Trial 3) and to decrease across trials for Group CA ($\overline{X} = 3.50$ for Trial 1, $\overline{X} = 2.88$ for Trial 2, $\overline{X} = 1.56$ for Trial 3). Since the learner's preoccupation with acquiring a new clustering strategy could result in an increase in errors as well as lower recall scores, a specific test of the effect of the interaction between Trials (first and

Table 3

Mean Statements Correctly Recalled and Means Errors

for the Concept Name (CN), Concept Attribute (CA), and Random (R) Groups*

Note-taking Treatment	Passage Organization	Trials 1	Trials 2	Trials 3	Total
		Statements Correctly Recalled			
Note-taking	R	4.00	6.38	9.62	6.67
	CN	6.00	11.25	15.62	10.96
	CA	6.88	12.25	16.50	11.88
Reading-only	R	4.62	8.25	9.00	7.29
	CN	8.00	10.75	13.88	10.88
	CA	5.25	10.62	12.88	9.58
		Errors			
Note-taking	R	2.88	3.62	3.62	3.38
	CN	2.00	3.38	2.12	2.50
	CA	3.88	3.75	2.25	3.29
Reading-only	R	2.50	2.12	3.50	2.71
	CN	.75	1.50	1.25	1.17
	CA	3.12	2.00	.88	2.00

* Note that in the Reading-only condition, Group CA recalled less statements and committed more errors on the first trial than did Group CN.

third) x Passage-organization (Groups CN and CA) was made separately for the Note-taking and Reading-only conditions. The means for these groups are summarized in Table 3. This analysis yielded t (84) = 1.50, $p < .10$ for the Note-taking group and t (84) = 2.34, $p < .05$ for the Reading-only condition. Much of the interaction effect in the CA Reading-only group appears to be accounted for by the drop in errors from the first trial ($\bar{X}$ = 3.12) to the third trial ($\bar{X}$ = .88). A comparison between these means yielded, t (84) = 2.70), $p < .01$.

Discussion

It is clear that passages consisting of organized sets of sentences resulted in more clustering and recall than randomly ordered sets of sentences. These findings are consistent with results obtained by Cofer, Bruce, and Reicher (1966) who used word lists and by Frase (1969) who used simple sentences. Thus, recall is facilitated when input is ordered in a manner where words or sentences are conceptually parallel in the sense that sentences deal with the same category.

A more interesting finding, however, is that each of the passage organizations influenced the selection of a clustering strategy by Ss who studied them. In the case of the passages organized by name or attribute, Ss identified organizational cues from the passage and incorporated these cues in the acquisition or selection of a clustering strategy. In the case of the passage in which sentences were randomly ordered, the organizational cues were not immediately apparent. Accordingly, the S must develop his own strategy, perhaps, as Frase has suggested, at the expense of learning the statements.

The present findings also lead us to imply that regardless of the passage organization, the strategy of clustering by names is more dominant than the strategy of clustering by attributes. The subjective organization

of materials by concept name may have been favored because it required the least amount of change from sentence to sentence and permitted relatively direct classification of information. Since the naming or labeling element of each sentence within a passage externally organized by CN remains the same within a given paragraph, only the value of the attribute changes. By using the CN clustering strategy, the S's task becomes comparable to learning six short serial learning lists, each of which is comprised of a set of CA values associated with a particular CN as represented in the six columns of Table 1. In this regard it is interesting to note that Ss who used the CN strategy often substituted ditto marks or the pronoun "it" for the concept name, suggesting a process resembling serial learning.

In the passage externally organized by CA, both the CN and CA elements differ from sentence to sentence, thereby requiring the acquisition of separate associations by the learner for each sentence. Thus, the CA passage resembles a paired associate task in which the same set of stimulus terms is paired with different response terms in each paragraph. As a result, the CN clustering strategy may have been preferred because it is more efficient; in a sense, it requires fewer associations for learning the same passage than does the CA clustering strategy.

The CN clustering strategy may also have been preferred because it tends to be more frequently employed in written materials. Thus, we are saying that experience in the culture may favor the use of the CN strategy. Nevertheless, whatever the reason for its selection, the CN clustering strategy appears to have been adopted by Ss studying the CN passage without notes and maintained at a high level throughout their efforts to learn the passage. In fact, Group CN organized so completely via the CN strategy

that there was very little use of the CA clustering strategy. This finding suggests that little interference between the two clustering strategies occurred for Group CN. In contrast, the CA strategy by Ss in Group CA was adopted during the third trial; i.e., only after some experience with the passage. During the earlier trials, the CA clustering strategy was matched by an almost equally high use of the CN clustering strategy. Thus, the CN strategy appears to compete with the adoption of the CA strategy for Group CA.

These findings suggest that the S has a dominant clustering strategy which is gradually relinquished when he finds it is not as appropriate as a subordinate strategy for learning a particular passage. He may be depicted, for illustrative purposes, as being in a "trade-off" situation in which he must weigh the problem of abandoning his preferred clustering strategy against the difficulty of reorganizing the passage. Apparently when note-taking is not permitted, the task of reorganizing the passage to fit his preferred strategy increases memory strain. He opts to relinquish the dominant strategy in favor of a subordinate clustering strategy more consistent with the organization of the passage as presented to him.

These findings imply that learners test clustering strategies for their effectiveness against the task requirements (Restle, 1962). When a strategy meets those requirements, it is retained; when it fails to meet those requirements it is rejected in favor of another which is sampled from a "pool" of strategies associated with similar tasks. From an instructional standpoint the importance of giving serious attention to the way in which material is organized is all too apparent from these findings.

The effect of taking notes while studying is important in several respects. Because note-taking can facilitate reorganization, it may change

the balance in the "trade-off" between abandoning the preferred clustering strategy and reorganizing the passage, rendering the reorganization alternative more attractive. When permitted to take notes, Ss do not appear to reduce the inconsistency between the organization implicit in the passage and their preferred clustering strategy by abandoning or modifying their strategy. Rather, they "modify" the passage to suit their own organizational schemes. From an instructional standpoint these findings point to the importance of giving serious attention to the way material is organized when students are not permitted to take notes. It is apparent that further research on efficient modes of organization may be a potentially fruitful endeavor.

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PROGRESS REPORTS

Project Ikon:

The Effect of Mnemonic Aids Employing Abstract and Concrete Pegwords With Verbal and Imaginal Mediators on Recall by High and Low Imagers

Study Director: Francis J. Di Vesta

Assistants: John Alivernini, Steven Ross, Phyllis Sunshine

Purpose

One phenomenon with which both students and teachers are familiar, often to their regret, is forgetting. This study is based on the assumption that such instructional strategies as those which employ mediational or mnemonic devices can be employed to facilitate memory. These mechanisms are mental elaborative operations performed on the material to be learned. Thus, the learner who employs a mnemonic aid does the following: 1) attends to the material; 2) thinks about it; 3) elaborates upon it; 4) imagines familiar connections for it; and 5) organizes it into units.

One class of mnemonic device is the "numeric pegword system" in which each pegword functions as a stimulus pigeonhole for a response word. Paivio hypothesized (1963) that the effectiveness of words as "conceptual pegs" depends on their capacity to evoke images that could mediate response recall. Ratings of the ease with which nouns elicit images indicate that concrete nouns exceed abstract nouns in rated imagery. Paivio (1966) suggests that concrete nouns presumably arouse non-verbal sensory images of their referent as well as verbal associates. Accordingly, it can be assumed that both images and verbal associates may be elicited as mediators by concrete nouns. On the other hand, abstract nouns, e.g.,

honor and mercy, do not refer to denotable objects, and thus are assumed to elicit more verbal responses than non-verbal images to provide "meaning" to the material being learned. Both non-verbal and verbal symbolic processes, however, can function as mediators although the effectiveness of each depends upon the relevant stimulus attributes (Yuille and Paivio, 1966).

The present study has three major objectives: (1) To compare the effects of instructions to use imagery or verbal mediation in a learning task; (2) to compare the function of concrete and abstract nouns in imagery and verbal forms as mnemonic aids; (3) to determine the effects on memory of the interaction between individual differences in imagery (or verbal ability) and the treatments consisting of kinds of instructions and characteristics of the pegwords.

Relevance for Instruction

This study is one among several in Project Ikon. As such its relevance is based on the assumption that a student's performance is affected by properties of the instructional materials. Furthermore, the evidence may suggest that an instructional set as well as the learning material may interact with the mental activities of students who have been identified as imagers or non-imagers. For example, it might be found that an imager profits more from instructions to mediate by imagery than by verbal mediators regardless of the concrete-abstract nature of the material to be learned; or, that an imager profits more from the use of imaginal mediators while verbalizers profit most from the use of verbal mediators; and so on.

Procedure

Four different experimental conditions were created by combining two different "mediational instructional modes" with two different "conceptual pegs." The two mediation modes were verbal and imaginal. The two conceptual pegs were a concrete noun jingle and an abstract noun jingle. The task was administered to subjects in groups of two to four. The first set of instructions presented to each subject explained the use of verbal and imaginal mediation. These were followed by instructions regarding the mode of mediation a group was to use. Subjects learned four successive lists of ten nouns in serial fashion. (There were two abstract lists and two concrete lists.) The learning task required subjects to relate each noun in the list to the corresponding jingle noun and to record his connection in either pictorial or verbal form. All subjects were tested for serial recall after each list and again after all four lists were recorded.

The data consisted of time scores, individual list recall scores and total recall scores.

Progress

Ninety-six subjects were run during the Fall term, 1970. The data is presently being analyzed.

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Project Ikon:

The Effect of the Interaction between Imagery, Abstractness, and Word Order on Paired-Associate Learning with Noun-Adjective Pairs

Study Director: Francis J. Di Vesta

Assistants: John Alivernini, Steven Ross, Phyllis Sunshine

Purpose

The study of imagery is currently enjoying a renewal of experimental interest. Not since the days of Galton's "breakfast table" questionnaire has imagery been so widely discussed by psychologists. However, unlike Galton's time, imagery is no longer defined solely as an individual difference variable. As Di Vesta (1970) noted in a previous report, imagery may also be viewed as a cognitive transformational process which effects the acquisition, coding, storage, and retrieval of learning material, and as a source of variation in environmental events. These views are accommodated in the present experiment in which the effect of concreteness, word order, and imagery are examined with reference to their effects on performance in a paired-associate (P-A) learning task.

Recent trends in imagery research have been strongly influenced by Lambert and Paivio's (1956) earlier experiment. These investigators demonstrated that despite English language habits a noun and its modifiers were learned more readily in the noun-adjective than in the adjective-noun order. They hypothesized that the advantage of nouns over adjectives as stimuli is the result of their capacity to evoke sensory images of concrete objects or events (Lambert & Paivio, 1963) and that these images

then mediated the correct response. The nouns presumably serve as "pegs" from which modifiers can be "hung." From this "conceptual peg" hypothesis it was predicted that concreteness, or image-producing value, would be most effective on the stimulus side of a P-A pair since it is the stimulus which must be the source of mediated recall.

In the present experiment it was assumed that because of the availability of objective referents, concrete words would evoke images more readily than abstract words. Paivio, Yuille, and Madigan (1968) did, in fact, find a substantial correlation between the rated values of words scaled on the dimensions of Imagery and Concreteness. It was further hypothesized that if concreteness were equal for both members of the pair, nouns would provide better "pegs" from which associates could be hung and retrieved because of their qualities for eliciting images. The third factor analyzed in the present study was the effect of differential effect of abstract and concrete pairings on the learning of high- and low-imagers.

Relevance for Instruction

Based on the experimentation to date, imagery appears to play a significant role in learning and language functions. It is reasonable to assume that an extended understanding of the processes underlying this variable will prove useful in improving instructional techniques. Thus, research might suggest instances when it would be advisable to explicitly encourage image production on the part of students to facilitate the attainment of some relationship. For instance, this technique might be especially useful in the development of language skills.

The ability to identify individual differences in imagery habits should also prove to be instructionally relevant. For example, Rohwer (1970) has identified a developmental trend in the imaging skills of children. His developmental requence is in opposition to the view that pictorial forms of representation precede verbal representation. The clarification of this issue would be a significant contribution to the development of efficient instructional procedures. The identification of imaginal practices and their interaction with the concreteness-abstractness dimension should prove relevant for an understanding of adult learning processes. The identification of an individual's basis for processing learning material could influence the development of efficient methods of presentation, especially if it is found that high-imagers deal more effectively with concrete materials and low-imagers (verbalizers) deal more effectively with (profit more from) abstract materials.

Procedure

This study was the second part of the three imagery experiments. Individuals who had been selected on the basis of test scores and who had participated in part I of the series served as subjects in this study.

Each subject learned a P-A list containing four each of concrete-concrete (C-C), concrete-abstract (C-A), abstract-concrete (A-C), and abstract-abstract (A-A) noun-adjective pairs presented in random order. Paivio's norms were used to select words that varied on concreteness while holding imagery and meaning constant. The factor of noun-adjective order was a between subject variable, therefore all the words in a list were in either noun-adjective or adjective-noun order.

Subjects were given two alternating study-recall trials. Pairs were presented on index cards which the subjects turned over at the sound of a bell at the rate of 10 seconds. During recall trials the subjects recorded their responses on mimeographed answer sheets.

The P-A lists were also presented to a separate group of subjects who were instructed to rate each pair for either imagery or degree of associative connection.

Progress

One hundred eighteen subjects were run in the P-A task. Forty-two subjects participated in the scaling procedure. The experimental data together with individual difference measures are currently being processed.

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Project Ikon:

The Effects of Context Modality on Acquisition and Transfer

For Imagers and Non-Imagers

Study Director: Steven M. Ross

Advisor: Francis J. Di Vesta

Purpose

A basic assumption in the present investigation concerns the notion that individuals are relatively idiosyncratic in their habitual and preferential manner of processing information. On this basis it seems likely that adults who have demonstrated a dependency on, and ability to use, concrete images in learning will perform in a manner that is specialized and discriminable from that of individuals who do not possess these qualities. It is the purpose of the present investigation to gain further insight as to the nature and effects of this individual difference by examining it as it interacts with materials that are embedded in visual and verbal contexts. This should provide additional understanding about the transformational abilities of individuals and properties of stimulus materials when viewed from the standpoint of context effects upon the storage and retrieval of experiences encoded in imaginal and symbolic form.

The present study extends the investigation appearing in an earlier report (Di Vesta & Ross, 1970) by treating context as a factor that differentially effects the perception and retention of stimuli, depending upon the form (modality) of the context and also upon the experiential history of the individual. Taken by itself, a stimulus will be subjectively

encoded in terms dictated by biases acquired as a consequence of prior experiences and in terms of the person's general familiarity with a given stimulus. The more ambiguous a stimulus, the more likely will be the tendency to attend to non-focal (contextual) cues in an attempt to provide structure and meaning to the stimulus. Take for example the following sentence: "The cardinal delivered his sermon on Sunday". In this situation, most individuals would experience little difficulty in defining "cardinal" as a type of clergyman. However, without the presence of the particular sentence (context), depending upon the person's previous experiences, he might be as likely to consider "cardinal" as a kind of bird. It seems intuitively obvious that, in these situations, context has an important influence on the perception, coding and storage of the experience in question. In this manner context determines the person's potential to transfer the material acquired to new situations. Our earlier investigations indicate support for these notions, but further inquiry was suggested to determine the effects of the interaction between context modality and individual differences in imagery on learning and transfer.

Considerable experimentation has been performed showing imagery to be a significant variable affecting the storage and retrieval of verbal and pictorial cues. Paivio (1970) employed the "conceptual peg" hypothesis in designing experiments to demonstrate the effects, on performance, of such variables as concreteness-abstractness of stimuli, modality of stimuli, and context of stimuli. Rohwer (1970) concluded that "action" prepositional connectives evoke more memorable kinds of imagery than either "static" or "coincidental" connectives. In other investigations involving verbal and pictorial transformations of stimuli, Reese (1970) found imaginal and sentence connectives to be equally facilitative for adults, but imagery

was less effective in providing contextual cues for children. These studies bear on the present research in their suggestion that materials presented in pictorial and verbal modalities are processed differentially according to the learner's capabilities and biases.

On the basis of the aforegoing rationale the present investigation was directed toward an examination of the general hypothesis that individual differences in specific attitudes or idiosyncratic predispositions towards learning influence fluency and preference in working with concrete pictorial images. Notions of this sort involving imagery have long been a subject of speculation by early philosophers and scientists (Richardson, 1969), but among the first empirical investigations involving the measurement of individual differences in imagery was the noted "breakfast table" questionnaire devised by Galton (1880). More recent investigations have yielded questionnaires (Betts, 1909; Gordon, 1949) and tests of spatial relations which appear to differentiate between "imagers" and "non-imagers" (see Richardson, 1969).

It seems relevant for basic inquiry and as an obvious extension of current imagery research, to examine more closely individuals who possess imagery skills as they interact with controlled environmental influences. In the present study, context is viewed as a pervasive and influential external (environmental) variable. Such cues provide the framework within which all experiences are embedded. By investigating context as an environmental factor and imagery as a distinctly biasing cognitive process, the present study was designed with the intent of providing further insights into the important question of how aptitude by treatment interactions affect learning.

Relevance for Instruction

Palermo (1970) stresses the need for the practical extension of the theoretical work that has been performed in imagery studies. If imagery can be shown as a measurable predisposition, on the one hand, and as a quantifiable stimulus property on the other hand, this fact should facilitate the prediction of student performances and improvement of instructional strategies through adapting instructional techniques to individual differences. Thus, in an instructional setting it would be important to understand that context does or does not influence learning, what the nature of this influence is, what kind of context should be provided, in what form or modality it should be constructed, and how these factors interact with the learning predispositions of students. For example, it may be determined that students who possess high imagery abilities can best benefit from instruction characterized by a context of concrete examples and graphic displays. It is conceivable that such persons might ignore or become distracted by symbolic formulations and abstractions.

Procedures

This experiment was the first part of a series of three related studies conducted during the same academic term. The subject pool for the three experiments consisted of approximately 300 students. They were administered three spatial relations tests and two vividness of imagery scales. In addition, the Scholastic Aptitude Test scores will be available along with an index of short term memory. From the original pool, 60 high imagers and 60 low imagers were selected to participate in the actual experiment.

The experiment consisted of two phases: learning and transfer. During the learning phase, all subjects learned a series of 20 paired-associates to a criterion of one perfect trial. The stimulus elements of the pairs were so selected that they belonged to two totally different, but reasonably common concept categories. In one variation, two accessory words, related to one of these concept categories were positioned between each main word pair. In another two, pictures having the same meaning as the accessory words were placed between the word pair. In the third variation no context of any modality was present. Subjects who had not reached criterion by 8 trials were released from the experiment. During the transfer phase, similar paired-associate lists were learned but without the inclusion of the context. The word pairs were comprised of the original response element and a new stimulus term which could suggest either the same concept or the concept not expressed by the original learning context. Latency of response as well as the number of correct responses were recorded for each trial. The overall design implies a 3 x 2 x 2 factorial analysis of variance.

Progress

This study is being conducted for a Master's thesis. All data has been collected and is now being analyzed.

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Project Ikon:

Factor Analyses of Test Batteries

Study Director: Francis J. Di Vesta

Assistant: Phyllis Sunshine

Purpose

The series of studies conducted under Project Ikon is based on the assumption that mediation may occur via imagery or symbolic modes. These may be viewed as subject to influence by instructional strategies (or experimental manipulations) or they may be viewed as comprising an individual difference variable. In the first instance the concern is with the manner in which stimulus variables, presentation modalities, instructional manipulations, and the like, affect the saliency of images versus verbalizations in such learning processes as forming associations, transfer to new situations, or memory. In the second instance, the concern is with dispositional behavioral tendencies toward individual preferences for employing either imaginal or symbolic mediational modes. Beyond these two orientations, there is a third interest related to the manner in which the two (aptitude x treatments) interact in affecting learning outcomes.

In order to understand the effect of individual differences it is necessary, of course, to identify means by which such differences can be measured. Accordingly, the present study is directed toward the factor analysis of several tests in an effort to determine whether an "imagery" component, distinct from a "symbolic" component, can be extracted.

Relevance for Instruction

Our progress in research in this area to date attests to the validity of the assumption that reliable individual differences exist in imagery among adults. The relevance of this research also rests on the assumption that identifiable properties of instructional materials can and do affect the performance of students. The research task is to identify bases for matching the properties of these materials to the mental activities of students who have been identified as imagers of verbalizers. Thus, for example, the evidence might suggest that visualizers (i.e., imagers) would profit most (from the standpoint of acquisition and retention) by the use of material presented pictorially rather than in abstract form. Since imagery as a process is a matter of transformation (encoding) an understanding of its limitations, that is, where it interferes with learning, would be essential for improving instructional strategy. Furthermore, we would expect contextual constraints to affect pictorial material differently than they would affect verbal material and these effects should interact with individual differences.

Procedure

In a first study several tests including tests of perceptual ability and of symbolic thinking were administered to three hundred students. The factor analysis of these data allowed the extraction of the two components, in addition to others (e.g., automatization), as hypothesized.

The first study was replicated in part with the addition of two subjective measures of imagery ability. There were two hundred subjects in the second study. A factor analysis of the second study again allowed the extraction of a component related to symbolic ability and another to

imaginal ability. In addition, because of the particular set of tests employed, a "social desirability" component was extracted.

Progress

The analyses for both studies have been completed. Because of the possiblity that the order in which the tests were administered may have affected certain of the results of the second study we are considering another replication.

Listening and Note-taking: II

Study Director: Francis J. Di Vesta

Assistant: G. Susan Gray

Purpose

Situational variables as well as learner characteristics can influence the ease in which a student learns in an educational setting. In an earlier sutdy (Di Vesta and Gray, 1970), these investigators found that the opportunity to take notes while listening to connected discourse, the opportunity to rehearse the material, and the occurrence of test-like events facilitated recall. The present study further investigates the learner-induced behaviors of note-taking and rehearsal in conjunction with situational variables of the thematic composition of the presented materials and of the spacing of rehearsal periods.

Memory span as an individual difference characteristic may hold a direct relationship to note-taking by limiting the amount of information the learner can process at a time while listening. A shorter memory span capacity may lead to adaptation by an increase in the learner's reliance on notes. The present study examines this possibility.

Relevance for Instruction

The instructor in an educational setting can manipulate characteristics of the material to be learned in order to maximize the efficiency of student learning. The thematic composition of a prose passage may be characterized by a single topic which is the substance of the entire

presentation. On the other hand, the textual material may cover several topics during an equal period of time. These different topics may vary in the degree of relatedness between them; they may be related to a super-ordinate concept or they may be completely unrelated. It would seem that the more related the contents of a presentation, the easier it would be for the learner to recall specific details incorporated in the material.

Assuming that the opportunity for rehearsal enhances recall, it is also possible to vary the occurrence of study intervals. They may be spaced at regular intervals during the course of a lecture, or occur as a massed study period at the end of the text presentation. Insight into the relative efficiency of the various types of textual themes and spacing of recall would enable an instructor to increase the learning efficacy of his students.

Procedure

Three 30-minute passages were prepared whose themes varied in degree of relatedness. In one passage, all 30 minutes were devoted to one specific topic. Another passage contained six different ideas (five minutes for each one) which were related to a common concept. A third passage was also comprised of six different ideas but there was no relationship among the topics. The thematic variable was orthogonally crossed with spacing of study intervals. Some subjects (one-third) listened for thirty minutes, then studied for twelve; another group of subjects listened to fifteen minutes of the material, studied for six minutes and repeated the listen-study sequence; a final third of the total number of subjects listened for five minutes, studied for two minutes, then repeated this listen-study sequence six times. One-half of the subjects in each of the aforegoing treatments were allowed to take notes, the other half were not allowed to

do so. Nine subjects were administered the task simultaneously. The use of language lab equipment permitted the manipulation of each of nine conditions at any one experimental session. The subjects listened to instructions and the task material over headphones at individual carrels. After the last study period, all subjects were given a free recall test, followed by a true-false test. In a second session, one week later, all subjects returned to take a second true-false test, and to take a short-term memory task modeled after the memory interference task of Peterson and Peterson (1959).

Progress

The data have been collected and are being analyzed.

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Recitation Strategies: The Effects of a Learner-Sustaining Climate and Encoding on Retention

Study Directors: Charles B. Schultz and Timothy R. Dangel

Purpose

Persons characterized as facilitators by the Achievement Anxiety Test (Alpert and Haber, 1960) appear to retain more from recitation strategies than debilitators, whose retention decreases as the rate of recitation increases (Schultz, 1970). The relatively poor performance of debilitators may be due to the fact that they "overload" short term storage with intrusions of irrelevant thoughts associated with anxiety. The purpose of the present experiment is to identify instructional treatments which reduce the debilitating effects of stress-producing situations such as recitation. Conditions which threaten an individual's self-esteem arouse anxiety (Ausubel, 1968). Accordingly, threat can be exaggerated or minimized by varying the extent to which an individual feels he is "on the spot" when reciting. In addition, the mode of verbal response can be varied to facilitate or inhibit retention. Information can be transferred from short term to long term storage by encoding, transforming, or otherwise relating new responses to existing elements of the individual's cognitive structure (Atkinson and Shiffrin, 1968). The act of translation may require the learner to process information so it is transferable to and retrievable from long term storage. Whereas verbatum repetitions of the information are more subject to decay and to

the effects of instrusions of irrelevant thoughts in short term storage. This rationale suggests that encoding can be manipulated by requiring either the translation of answers into original wording or the verbatum repetition of answers.

A major expectation of this study is that translation in a sustaining climate facilitates retention for debilitators to a point where it equals retention for facilitators. Translation or verbatum recitation in non-sustaining climates inhibits retention for debilitators relative to facilitators.

Relevance for Instruction

A relatively large proportion of instruction is devoted to recitation exercises (Hoetker and Ahlbrand, 1969). Since these activities appear to have differential effects on learners, it is important to identify instructional treatments which will improve the performance of those who are debilitated by stress-producing situations. The treatments and procedures of the present experiment are directly analogous to classroom conditions. Therefore, the results hold direct implications for improving the performance of debilitators in instructional settings. If the expectations of this study are met, the sensitazation of instructors to conditions which produce sustaining climates and remediational programs which provide debilitators skill in encoding are suggested.

Procedure

Essentially, the procedures reported in an earlier study by Schultz (1970) were repeated. Groups of six subjects who were selected on the basis of extreme scores on the AAT, responded to recitation questions by finding and reciting answers from printed textual material. In the

present study, all subjects were asked three questions. Climate was varied by modifying the instructions to emphasize or minimize the evaluation of the subjects' responses before the group and by offering or withholding praise after correct responses. These manipulations were designed to produce a directive and sustaining climate. Half of the subjects in each climate condition were instructed to respond with the exact words in the printed text (i.e., the verbatum response mode). The remainder were instructed to rephrase the text (i.e., the translation response mode). These manipulations imply a 2 x 2 x 2 factorial analyses of variance design with two levels of climate (directive and sustaining), two levels of response mode (verbatum and translation) and two personality types (debilitators and facilitators).

Progress

The AAT has been administered to students of a local high school. Extreme scorers have been selected and the experiment is presently being conducted.

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The Effects of Recall Interval Expectancy and Note-taking on Immediate and Delayed Retention

Study Director: Paul Weener

Assistant: Sam Rock

Purpose

The way in which a student actively operates on visually presented instructional material is dependent on his expectancy of when the presented material will have to be retrieved. Material which is going to be recalled immediately requires different information processing strategies than material which is going to be recalled much later. For the former, simple rehearsal processes may be adequate; for the latter, reorganization and coding would seem to be more important. Furthermore, instrumental activities, such as note-taking and verbalization, which the learner engages in while studying probably serve a different function depending on the interval between stimulus presentation and recall. Previous research (Weener, 1971) showed that the expectancy that presented instructional material will have to be recalled immediately after studying the material leads to greater immediate and delayed learning than the expectancy for delayed (one week) recall of the instructional material. Furthermore, the experimental groups which took the most notes tended to do less well on the criterion essay test based on the instructional material. It is the puspose of the present research to extend and replicate these earlier findings in order to determine the effects of note-taking and expected recall interval on both immediate and delayed recall of instructional material.

Relevance for Instruction

The expected recall interval seems to influence both how much is learned and the activities of the learner during study. Significant differences supporting the previous finding would provide strong evidence for providing immediate recall expectancies in long-term instructional programs. If the note-taking activity can be shown to be detrimental in the present research, it would imply that the practice of note-taking should be discouraged in situations where the notes will not be available for later reference. The practice of note-taking, which has been demonstrated to have beneficial effects in some instructional settings (Di Vesta and Gray, in press; Peters and Harris, 1970), may be detrimental in other settings. Instructors can utilize such information to guide student note-taking activity.

Procedure

Eight different experimental conditions were created by completely crossing three two-level factors: (1) note-taking - no note-taking; (2) immediate test expectancy - delayed test expectancy; (3) immediate test - delayed test. Groups of eight participated in the experiment. Each of the subjects was presented with instructions which stated that he was to read and study a short article, that he could or could not take notes, and that he would be tested immediately after studying or one week later. The material which was studied for thirty minutes was a rather difficult passage dealing with principles governing the development of species.

Half of the subjects were tested both immediately and one week later; half were tested one week later only. The immediate test consisted of a free recall test and an essay test; the delayed test consisted of a free recall test, an essay test, and a multiple-choice test.

Progress

One hundred sixty subjects were run during the Fall term, 1970.

The data is presently being scored and analyzed.

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Learning Outcomes as a Function of Type of Test Expected

Study Director: Nicholas M. Sanders

Purpose

In discussing the relative values of essay versus fill-in-the-blank, alternative choice or matching tests, one usually discusses several measurement issues. It is often argued that essay tests in general and many short answer tests are lacking in inter-scorer reliability and the extent of content validity. On the other hand, instructors often feel that the organization of ideas manifest in essay tests represents a more valid measure of their instructional aims than do other types of tests. The present research is an attempt to demonstrate (1) that essay tests do measure a type of learning different from that measured by a recognition or cued-recall test, and (2) that the expectation of one type of test will lead to a different type of learning outcome from the learning involved when another type of test is expected.

An essential difference between essay tests and the other types of tests mentioned above is response organization. In an essay test recall of individual items of subject matter is not sufficient; the items must be placed in a particular order or sequence, one item added to the others at a particular point in the development of the answer. By contrast, short answer items and multiple-choice tests require only that the particular items of information be recalled upon a cue, which is provided by the question. By implication the learner must be concerned about learning

interrelationships among the bits of information acquired in order to do well in an essay test, while he may adopt any ordering or arrangement of the ideas that makes the individual information items retrievable to do well on a cued recall or recognition test.

Some theories of learning of verbal material provide a framework for understanding underlying differences in the learning demands of different types of tests. Jensen (1962) has presented a theory of serial learning that may be applied to the psychological basis for performance on an essay exam. He suggests that the learner must integrate the whole list of words as a response; this operation is analogous to the activity of a child who is learning to read a particular word when he is already familiar with the letter components of the word. To extend the analogy to the essay test, the total essay is seen as the word, while the individual ideas are the letter components.

Tulving's (1964) analysis of free recall learning provides a framework for understanding processes underlying performance on tests in which remembering individual items alone is important. Tulving proposes that improvement in number of items that can be recalled during a test is a function of study time, which provides the opportunity for the learner to organize the list of words in an order that facilitates his memory of them. This learner process is referred to as subjective organization. Subjective organization often differs from the organization imposed through order of presentation of the words. Though the exact nature of subjective organization is not specified, the critical aspect of Tulving's suggestion for the present discussion is that an order of ideas manifest in the presentation of those ideas may be supplanted by a subjective order, to facilitate memory of individual items. Thus, a learner who performs

well on a test requiring recall of isolated information items may have rearranged the order of items to fit his prior cognitive structure instead of attempting to master the developmental sequence of ideas as presented by the instructor or text.

Utilization of the Jensen (1962) and Tulving (1964) analyses implies processes that facilitate performance in essay tests differ from those that lead to greater recall in tests for memory of individual items. Also implied by these analyses is that the processes may conflict. If a learner is tying together a sequence of ideas as presented, he cannot be subjectively reorganizing the component ideas. On the other hand, if the learner is engaged in subjective organization of the ideas, he will not be integrating the ideas as they are developed in presentation. Only when the order of ideas as presented is congruent with the learner's subjective organization will the two processes not be conflicting.

Finally, if we assume that college students are relatively proficient with both response integration and subjective organization, the particular study procedure utilized by the student is assumed to be a function of the type of test he expects. If he expects an essay test, response integration is the process most appropriate. If he expects to be tested for number of ideas remembered, subjective organization is the appropriate type of studying.

Relevance for Instruction

The main thrust of this area of research is to demonstrate that testing procedures are part of instruction and therefore partly direct the student's learning processes. If the present research provides adequate support for this thesis, the implication would be that essay tests

are more appropriate when the educational objective is learning a specified interrelationship among a set of ideas, but that tests of recall of individual items of information, such as multiple-choice or short answer tests are more appropriate when the objective is amount of information.

Procedure

Students from an introductory educational psychology class shall participate in individual, laboratory sessions. The students will be given three different lists of words to study, and they will be tested for recall of the words in the list immediately after they study each list. One-half of the students will be instructed to study each list to recall as many of the words as possible, and the tests on the first two lists of words will call for recall of the words in any order the student chooses (free recall). The other students will be told to study the lists for the order in which the words are presented, and their first two tests will require memory of the order in which the words were presented (serial recall). The instructions on the third test for all students shall indicate that the student is to recall as many words as he can and put the words into the order in which they were presented. The third test provides the major dependent variables, and will be scored for amount recalled and the extent to which the presented order of words is manifest in the recalled order. A second set of the same two dependent measures will be acquired by having the students take the third test a second time, separated from the first testing on the third list by a fifteen minute intervening task designed to interfere with the recall of the third list words.

In addition to manipulation of test expectancy, two different lengths of study time will be considered. One-half of the students in each test expectancy condition will be given one and one-half times as much study time as the other students. This study time variable is included to determine the generalizability of test expectancy effects across study or rehearsal times.

Progress

The initial literature search has been completed. The materials for the study have been selected and are presently undergoing pilot study. Appropriate study and testing intervals are also being studied empirically.

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The Effects of Congruence Between Passage Organization and an Imposed Clustering Strategy on Recall

Study Directors: Francis J. Di Vesta and Charles B. Schultz

Assistant: Timothy R. Dangel

Purpose

Several studies have demonstrated that organized passages result in greater recall than randomly ordered passages, that clustering in recall is influenced by passage organization, and that the concept name clustering strategy is preferred over the concept attribute strategy (Frase, 1969; Schultz and Di Vesta, 1971). Clerical employees and high school students were used as subjects in these experiments. One purpose of the present study is to replicate these findings with college students who were assumed to be more verbally adept and to have had more experience studying written materials with different organizational patterns.

In the above mentioned study by Schultz and Di Vesta (1971), subjects tended to relinquish their preferred concept name clustering strategy and adopt a subordinate strategy which was consistent with the concept attribute passage organization only after several exposures to that passage. The present study was designed to provide a replication of that finding. In addition, Schultz and Di Vesta (1971) found a tendency for recall to be impaired in the early stages of learning the concept attribute passage. Since this finding suggests that the use of concept name strategy was inappropriate, in the present study the

congruence between the passage organization and the subject's clustering strategy was directly manipulated. Accordingly, three levels of passage organization (concept name, concept attribute, and random) were orthogonally crossed with three sets of instructions for learning the passage (group by concept name, group by concept attribute, and no grouping instruction).

Relevance for Instruction

Much of the student's efforts to learn are devoted to the study of written materials. If the organizational properties of these materials influence learning and retention, the identification of these variables and the conditions which maximize their effects on learning are important for more effective instruction. Presumably, organizational factors contribute to the effectiveness or lack of effectiveness of textual materials and lecture presentations. Remedial programs to develop skills in the acquisition and selection of clustering strategies to facilitate recall also may be suggested by the present program of research.

Procedures

College students were given three brief study periods to learn a passage which described six imaginary nations. Each study period was followed by a writing period consisting of a free recall test. A task requiring the recall of three-letter nonsense syllables followed the third writing period. This task was intended to prevent rehearsal of the previously learned material before the administration of a fourth free recall test. Finally, a fifth free recall test was administered

approximately one week after the experimental session. The number of correct responses and clustering ratios were obtained from each of the five free-recall tests.

One experimental dimension consisted of manipulating the organization of the passage. Descriptions of the experimental passages were presented earlier (Schultz and Di Vesta, 1971). Briefly, some subjects read a passage organized by name, while others studied either a passage organized by attribute or a randomly ordered passage.

One-third of the subjects assigned to each of the passage organization conditions were given instructions to learn the passage by grouping the material according to the concept name. That is, they were instructed to group all the statements about the same nation together and to learn them this way. One-third of the subjects were given instructions to learn the passage by grouping the material by concept attribute. These subjects were instructed to group all the statements about the same type of characteristic together and to learn them this way. The remaining one-third of the subjects assigned to each of the passage conditions were instructed to study the material any way that would help them to remember it. These manipulations imply a 3 x 3 x 5 factorial analysis of variance with repeated measures (trials) on the last factor.

Progress

The collection of data has been completed and analyses are now being conducted.

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